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A revision of the nematode family Cephalobidae Chitwood and Chitwood, 1934. GERALD THORNE, U. S. Bureau of Plant Industry (Salt Lake City, Utah).

A study of over sixty species of Cephalobidae Chitwood and Chitwood (1934, Proc. Helminth. Soc. Wash. 1:8-9) has revealed certain relationships which make possible a revision of the family and reallocation of most of the known species, principally upon the basis of arrangement and development of stomatorhabdions (Steiner, 1933, J. Parasitol. 20:66-68) and cephalic appendages. With the possible exceptions of *Daubaylia* Chitwood and Chitwood (1934, loc. cit.) and *Chambersiella* Cobb, (1920, Contrib. Sci. Nematology IX, 278-279) of which suitable material has not been available, all genera come under two types of stomatorhabdion arrangement:

1. *Panagrolaimoid.*—Cheilostom and prostom forming a broad chamber; meso-, meta- and telostoms narrow. Pharyngeal musculature enveloping only bases of prorhabdions (fig. 1, A).

2. *Cephaloboid.*—Cheilostom a broad chamber; protostom and telostom narrow. Pharyngeal musculature enveloping the entire prorhabdions (fig. 2, M).

Stomatorhabdions are best observed on living specimens. Fixation frequently causes distortions which make detailed observations impossible. In such cases the enveloping musculature usually will indicate which type is present.

The cephalic processes of *Acrobeles* and related genera were designated "probolae" by the writer (1925, Trans. Amer. Micros. Soc. 44:172) the inner circlet of 3 being termed "labial," the outer circlet of 6 "cephalic." At that time the cephalic circlet of *Acrobeloides bütschlii* (deMan, 1884) Steiner and Buhrer, 1933, and related species, was conceived to be absent. However this was an error for the rounded axil borders (fig. 4, F, *ceph pr*) are homologous to the elaborate processes of *Acrobeles ciliatus* von Linstow, 1877 (fig. 4, O).

Cephalobus Bastian (1865, Linn. Soc. Lond. Trans. 25:124-125) is here diagnosed on the basis of species without probolae since Bastian's description and figures do not indicate that they are present on *C. persegnis* Bastian, 1865, the type species. This species is plainly shown without probolae by deMan (1884, Die, frei in der reinen Erde und im süssen Wasser lebenden Nematoden etc. pl. 13, fig. 52) and the writer (1925, Trans. Amer. Micros. Soc. 44:175) observed that it possesses blunt, asymmetrical lips which only somewhat resemble probolae. Therefore Steiner's (1934, Proc. Helminth. Soc. Wash. 1:54) conception that probolae are present on this species has been abandoned.

The cephalic processes of *Chambersiella rodens* Cobb, 1920 and *Acrobeles ciliatus*, type species of the new subfamilies Chambersiellinae and Acrobelinae respectively, are distinctly different. The inner, or labial circlet on *C. rodens* consists of 6, mandible-like, biting organs ("odontia") arched over the pharynx while in *A. ciliatus* there are 3 forward pointing processes ("probolae"). The outer, or cephalic, processes of *C. rodens* are 6, apparently filamentose, compound-branched, "cirri" while *A. ciliatus* possesses 6 broad, flap-like, cephalic "probolae" of an entirely different structure.

Diagnoses are not repeated in the following discussion except where emendations have been necessary. Figures of heads are uniformly 2,000X; tails and other body parts 750X unless stated otherwise.

Key to Subfamilies and Genera of Cephalobidae

1. Stoma much reduced, only cheilorhabdions developed. Basal esophageal bulb without valvular apparatus
   Subfamily Daubayliinae Chitwood and Chitwood, 1934
   Genus *Daubaylia* Chitwood and Chitwood, 1934
   Stoma not reduced. Basal esophageal bulb with valves 2
2. Lip region bearing 6 odontia and 6 cirri
   Chambersiellinae, new subfamily
   Genus *Chambersiella* Cobb, 1920
   Lip region without odontia and cirri 3
3. Pharyngeal armature Cephaloboid. Double flexure in ovary posterior to vulva (except in occasional aberrant specimens). Spermatheca present at anterior flexure of ovary. Annules about 2μ or more wide 4
   Pharyngeal armature Panagrolaimoid. Ovary never with double flexure posterior to vulva. No spermatheca present at anterior flexure of ovary. Annules fine, much less than 2μ ..... Panagrolaiminae, new subfamily 5
4. Lip region bearing 3 labial, and frequently 6 cephalic probolae
   Acrobelinae, new subfamily 12
   Lip region without probolae ..... Subfamily Cephalobinae Filipjev, 1934 11
5. Circlet of 6 setose cephalic papillae present ..... *Macrolaimus* Maupas, 1900
   Cephalic papillae not setose 6
6. Post corpus of esophagus bulbar, separated by a distinct break in the corporeal lining ..... *Tricephalobus* Steiner, 1936
   Post corpus of esophagus not bulbar 7
7. Isthmus about as long as corpus; plate-like denticles frequently, perhaps always, present in pharynx ..... *Panagrodontus* Thorne, 1935
   Isthmus much shorter than corpus; plate-like denticles absent in pharynx 8
8. Ovary lying entirely anterior to vulva ..... *Plectonchus* Fuchs, 1930
   Ovary extending caudad past vulva 9
9. Cheilostom hexagonal, the rhabdions conspicuous ..... *Procephalobus* Steiner, 1934
   Cheilostom triquetrous, the rhabdions obscure 10
10. Male with ventromedian, preanal papilla ..... *Neocephalobus* (Steiner, 1929)
    Male without ventromedian preanal papilla ..... *Panagrolaimus* Fuchs, 1930
11. Wings extending to caudal terminus, female tails blunt and rounded
    Cephalobus Bastian, 1865
    Wings extending only to phasmids, female tails attenuated
    Eucephalobus Steiner, 1936
12. Labial probolae massive, low-rounded or furcate plates 13
    Labial probolae slender-furcate or elaborately fringed 16
13. Cephalic axils dentate, female tails concave-conoid to acute or subacute terminus ..... *Zeldia*, n. g.
    Cephalic axils not dentate, (except minutely in *trifurcatus*), female tails bluntly-rounded, rarely convex-conoid 14
14. Labial probolae, at least the dorsal one, furcate, the submedian ones usually asymmetrical ..... *Chiloplacus*, n. g.
    Labial probolae low, rounded, not furcate 15
15. Esophagus well developed with enlarged postcorpus, cuticle near head with simple annules ..... *Acrobeloides* (Cobb, 1924)
    Esophagus slender throughout, cuticle near head divided into plates
    Placodira, n. g.
16. Labial probolae elaborately fringed ..... *Acrobeles* von Linstow, 1877
    Labial probolae slender-furcate, rarely with a few branches 17
17. Cuticle with transverse striae only ..... *Cervidellus*, n. g.
    Cuticle with both longitudinal and transverse striae ..... *Stegella*, n. g.

Subfamily Daubayliinae Chitwood and Chitwood, 1934

Type genus and species.—*Daubaylia potomaca* Chitwood and Chitwood, 1934.

Panagrolaiminae, new subfamily

Diagnosis.—Cephalobidae: Pharynx panagrolaimoid. Nerve ring surrounding isthmus near middle. Female sexual apparatus extending forward then reflexed straight back past vulva without additional flexures. Uterus functioning as seminal receptacle. Annules fine, often obscure, always distinctly less than 2μ. Gubernaculum appearing in cross section as irregular polygon (except *Panagrodontus*).

Type genus.—*Panagrolaimus* Fuchs, (1930, Zool. Jahrb. 59:586-588).

Genus *Panagrolaimus* Fuchs, 1930

Diagnosis (emended).—Panagrolaiminae: Lips generally duplex, rarely amalgamated, the submedian usually asymmetrical. Inner circlet of labial papillae frequently located on the outer contour of lips. Outer circlet sometimes slightly elevated but never setose. Pharynx without plate-like denticles. Cheilostom triquetrous, the rhabdions obscure. Esophagus typical, without corporeal bulb, isthmus shorter than corpus. Nerve ring surrounding isthmus near middle. Ventromedian male preanal papillae absent.

Type species.—*Panagrolaimus detritophagus* Fuchs, (1930, loc. cit. 588-591).

Other species included.—

Panagrolaimus annulatus (Skwarra, 1921), n. comb.

Synonym.—*Cephalobus annulatus* Skwarra, 1921

Panagrolaimus chalcographi Fuchs, 1930

Panagrolaimus subelongatus (Cobb, 1914), n. comb.

Synonym.—*Cephalobus subelongatus* Cobb, 1914

Panagrolaimus heterocheilus Steiner, 1935

Panagrolaimus picei Fuchs, 1930

Panagrolaimus piniperidae Fuchs, 1930

Panagrolaimus rigidus (A. Schneider, 1866), n. comb.

Synonyms.—*Leptodera rigida* A. Schneider, 1866

Anguillula rigida (A. Schneider, 1866) Bütschli, 1876

Cephalobus rigida (A. Schneider, 1866) Oerley, 1880

Cephalobus oxyuris Bütschli, 1873

Rhabditis aquatica Micoletzky, 1913

Panagrolaimus sexdentati Fuchs, 1930

Panagrolaimus superbus Fuchs, 1930

Panagrolaimus venustus Fuchs, 1930

The two most common species of *Panagrolaimus* occurring in the United States are *P. subelongatus* and *P. rigidus*. These have frequently been incorrectly identified as *Cephalobus elongatus* by the writer and doubtless others have made the same error.

Panagrolaimus subelongatus (Cobb, 1914), n. comb.

Diagnosis.—♀ : 0.7-1 mm; $a = 20$; $\beta = 4.3$; $\gamma = 21$; V—^{20}63.^{27}

♂ : 0.7-0.9 mm; $a = 25$; $\beta = 4$; $\gamma = 20$; T—60.

Lips duplex, the submedian generally distinctly asymmetrical. Inner circlet of papillae usually located on outer contour of lips. Lips quite variable in form, frequently much more rounded than those shown (fig. 1, A). Isthmus slightly more than one-third length of corpus. Terminus variable, sometimes more pointed, sometimes blunter than illustrated (fig. 1, B & C).

Panagrolaimus rigidus (A. Schneider, 1866), n. comb.

Diagnosis.—♀ : 1-1.3 mm; $a = 22.5$; $\beta = 5.9$; $\gamma = 15$; V—^{29}59.^{18}

♂ : 0.7-1 mm; $a = 28$; $\beta = 5.5$; $\gamma = 18$; T—65.

Species closely resembling *Panagrolaimus subelongatus* but with comparatively broader head, generally lower lips, shallower pharynx and more acute tail. Isthmus about one-fourth length of corpus (fig. 1, D-F).

Panagrolaimus obesus, n. sp. (fig. 1, G-I)

Diagnosis.—♀ : 0.65 mm; $a = 12.5$; $\beta = 5$; $\gamma = 18.5$; V—[38] 66.[28]
♂ : 0.6 mm; $a = 14.3$; $\beta = 5$; $\gamma = 20$; T— 67.

Principal diagnostic points given in measurements and figures. Lips amalgamated, low, rounded, the dorsal one sometimes with a slight depression separating the two apical papillae. Body ventrally narrowed at vulva. Corpus of esophagus 2½ times length of isthmus and more than half as wide as neck, narrowing abruptly to isthmus. Nerve ring at middle of isthmus. Excretory pore opposite nerve ring. Gonads sometimes reaching base of esophagus. Ovary usually extending into tail cavity.

Habitat.—Frass of beetle, *Desmocerus* sp. in stems of elderberry, *Sambucus glauca* Nutt., Little Cottonwood Canyon near Salt Lake City, Utah.

Genus *Neocephalobus* (Steiner, 1929) Steiner, 1934

Synonym.—*Cephalobus* (s. g. *Neocephalobus*) Steiner, 1934.

Type species.—*Neocephalobus aberrans* (Steiner, 1929) Steiner, (1934, Proc. Helminth. Soc. Wash. 1:54).

Synonym.—*Cephalobus* (*Neocephalobus*) *aberrans* Steiner, (1929, J. Parasitol. 16:88-89).

Apparently the only character definitely differentiating *Neocephalobus* from *Panagrolaimus* is the presence in the male of a ventromedian, preanal papilla.

Species included.—*Neocephalobus leucocephalus* Steiner, 1936.

Genus *Procephalobus* Steiner, 1934

Type species.—*Procephalobus mycophilus* Steiner, (1934, Proc. Helminth. Soc. Wash. 1:55).

Steiner (1935, Proc. Helminth. Soc. Wash. 2:110) made *Procephalobus* a synonym of *Panagrolaimus* but the hexagonal cheilostom with its conspicuous rhabdions (fig. 1, K-M) is unique among Panagrolaiminae and should entitle it to generic standing.

Genus *Tricephalobus* Steiner, 1936

Type species.—*Tricephalobus longicaudatus* (Bütschli, 1873) Steiner, (1936, Proc. Helminth. Soc. Wash. 2:79).

Synonym?—*Cephalobus longicaudatus* Bütschli, 1873.

The definite bulb-like apparatus of the post corpus (fig. 1, J) is the most outstanding feature of this genus, being the only example of corporeal bulb known among the Cephalobidae. The presence of 3 lips, from which the generic name originated, is not an outstanding character because such forms occur in *Panagrolaimus, Cephalobus, Eucephalobus* and *Panagrodontus.*

There is a question that the form described by Steiner is the species observed by Bütschli, deMan and others because it scarcely seems possible that these workers all would have overlooked the conspicuous corporeal bulb.

The genus *Pseudorhabditis* Kreis, (1929, Zool. Anz. 84:(11/12) 288) appears to be closely related to *Tricephalobus.* Kreis does not mention or figure the meso-meta- and telorhabdions. Possibly *Pseudorhabditis* should have been included in the Panagrolaiminae.

Genus *Panagrodontus* Thorne, 1935

Type species.—*Panagrodontus deniatus* Thorne, (1935, J. Agr. Research, 51:142-143).

Other species included.—

Panagrodontus tigrodon (Fuchs, 1930), n. comb.

Synonym.—*Panagrolaimus tigrodon* Fuchs, 1930.

Panagrodontus cornutus (Fuchs, 1930), n. comb.

Synonym.—*Panagrolaimus cornutus* Fuchs, 1930.

Considerable variation in the location of denticles occurs in this genus. Fuchs (1930, Zool. Jahrb. 59:596) shows them as being on the prorhabdions and

mesorhabdions in *P. tigrodon* while in *P. dentatus* the single, plate-like denticle is on the dorsal mesorhabdion. In the new species *P. armatus*, (fig. 2, A) they are on the metarhabdions. In species like *P. armatus* these denticles are very difficult to observe on dead specimens and may more easily be overlooked, as perhaps they were in *P. cornutus*.

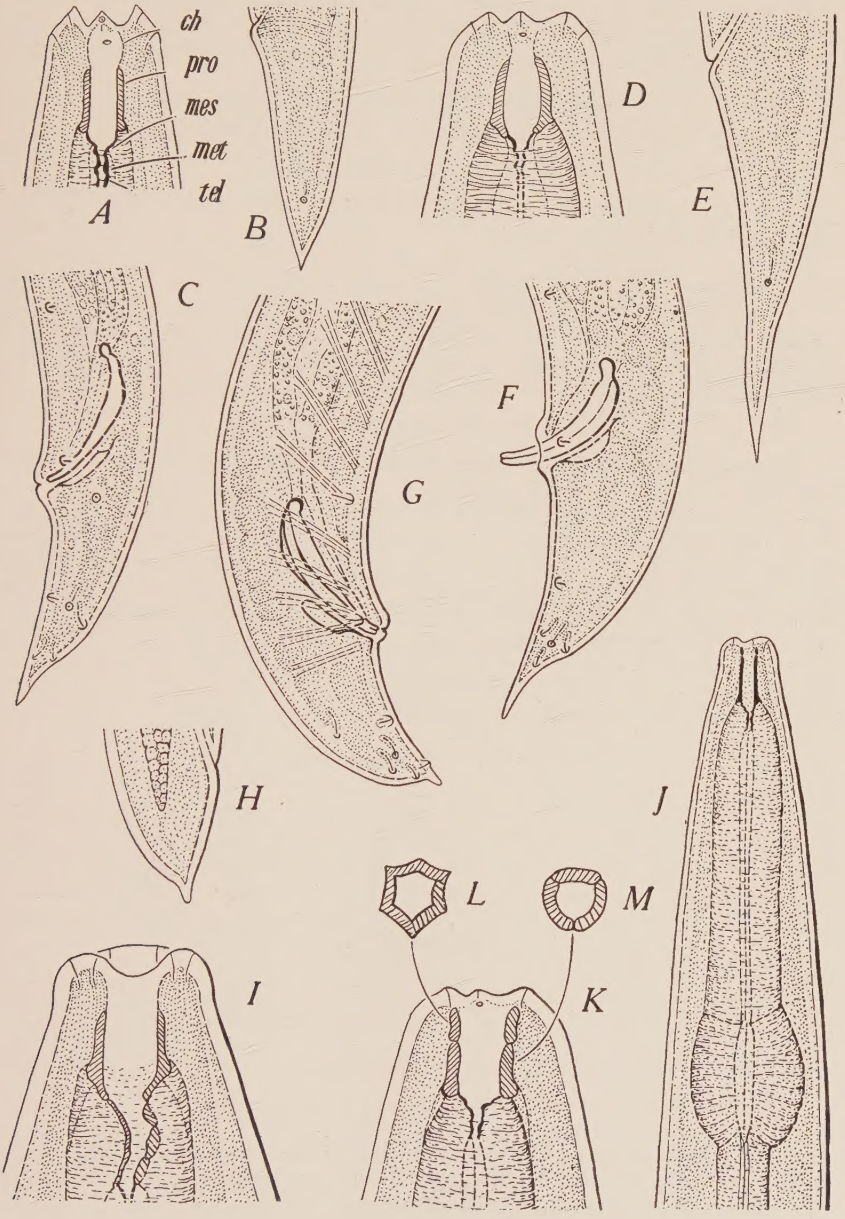

FIG. 1

A-C—*Panagrolaimus subelongatus* (A—Head; *ch*, cheilorhabdion; *pro*, prorhabdion; *mes*, mesorhabdion; *met*, metarhabdion; *tel*, telorhabdion). D-F—*Panagrolaimus rigidus*. G-I—*Panagrolaimus obesus*. J—*Tricephalobus longicaudatus*. K-M—*Procephalobus mycophilus* (L—Cross section of cheilorhabdions. M—Cross section of prorhabdions).

Panagrodontus armatus, n. sp. (fig. 2, A-D)

Diagnosis.—♀ : 0.55 mm; $a = 16.7$; $\beta = 4.7$; $\gamma = 11.1$; V—^{20} 62.^{18}
♂ : 0.45 mm; $a = 18.5$; $\beta = 5$; $\gamma = 10$; T—50

Pharynx armed with 1 dorsal and 2 ventrosubmedial denticles which are moveable and assist in forcing the food back into the esophagus. These are enclosed within a small vestibule (fig. 2, B). Esophageal corpus half neck-width and slightly longer than isthmus. Bulb two-thirds as wide as neck base. Ovary extending about half-way between vulva and anus. Tails of both sexes spicate (fig. 2, C & D).

Habitat.—Frass of mountain pine beetle, *Dendroctonus monticolae*, Ashley Forest, Utah. Collected by L. J. Farmer, U. S. Forest Service.

Genus *Plectonchus* Fuchs, 1930

Type species.—*Plectonchus cuniculari* Fuchs, (1930, Zool. Jahrb. 59:566-568) (First designation of type).

Other species included.—

Plectonchus ateri Fuchs, 1930

Plectonchus ligniperidae Fuchs, 1930

The ovary lying completely anterior to the posteriorly located (74%) vulva constitutes the principal diagnostic character of this genus. A careful examination of the pharyngeal structure may reveal other valuable characters.

Genus *Macrolaimus* Maupas, 1900

Type species.—*Macrolaimus crucis* Maupas, (1900, Arch. Zool. Expér. et Gén. 8:578-582).

The prominent circlet of 6 setose, or horn-shaped, papillae (fig. 2 ,F) immediately differentiates this genus from other Panagrolaiminae. Other distinguishing characters are: The broad head; lips arched over pharynx; characteristic arrangement of stomatorhabdions and slightly enlarged base of esophageal corpus. When observed alive, both of the American species described herein were exceedingly active, strong swimmers.

Other species included.—

Macrolaimus aculeatus (Daday, 1905), n. comb.

Synonym.—*Cephalobus aculeatus* Daday, 1905.

Macrolaimus taurus, n. sp. (fig. 2, E-J)

Diagnosis.—♀ : 1.3 mm; $a = 30$; $\beta = 5.9$; $\gamma = 18$; V—^{15} 60.^{20}
♂ : 1.1 mm; $a = 31$; $\beta = 5.8$; $\gamma = 21$; T—57

Annules about 1.3μ wide. Wing area marked by 2 lines. Circlet of 6 horn-like papillae at margin of head. Lips forming a slight arch over vestibule. Details of pharynx and esophagus as illustrated. Lips of vulva protuberant, anterior lip the larger. Female tail slightly arcuate, tapering to the abruptly connate terminus. Details of male tail as illustrated (fig. 2, G). Note the large, roughly-triangular gubernaculum.

Habitat.—Frass of *Ips confusus* Leconte in pinyon pine, *Pinus edulis*, collected near Tabiona, Utah, by L. J. Farmer, U. S. Forest Service.

Macrolaimus hamatus, n. sp. (fig. 2, K & L)

Diagnosis.—♀ : 0.8 mm; $a = 31$; $\beta = 4$; $\gamma = 13.7$; V—^{16} 55.^{20}
♂ : 0.7 mm; $a = 32$; $\beta = 4$; $\gamma = 14.5$

Cuticle with annules about 0.5μ apart. Lips forming a high arch over vestibule. Cheilostom about 3 times depth of protostom. Esophagus similar to that of *Macrolaimus taurus* (fig. 2, J). Details of male tail as shown (fig. 2, L). Female tail somewhat longer and more tapering than that of male with a similar hooked terminus.

Habitat.—Spanish moss near Tifton, Georgia, collected by A. L. Taylor, Division of Nematology.

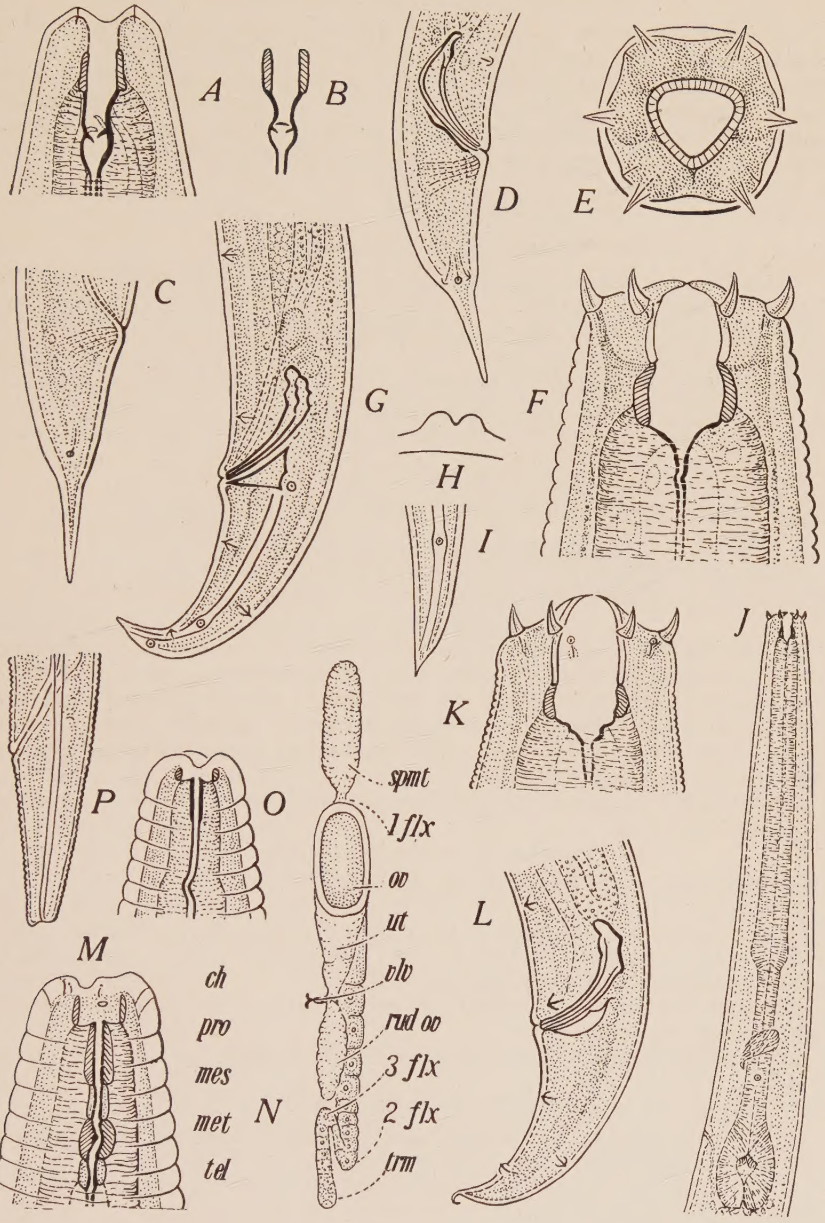

FIG. 2

A-D—*Panagrodontus armatus* (A—Head, lateral view, dotted outlines of denticles mark range of observed movement. B—Pharnyx, ventral view). E-J—*Macrolaimus taurus* (E—Face view. F—Head, lateral view. G—Male tail; X 500. H—Cross section of wings; X 2,000. I—Terminus of female; X 500. J—Anterior end; X 375). K & L—*Macrolaimus hamatus*. M & N—*Cephalobus persegnis* (M—Head; *ch*, cheilorhabdion; *pro*, prorhabdion; *mes*, mesorhabdion; *met*, metarhabdion; *tel*, telorhabdion. N—Female reproductive system; *spmt*, spermatheca; *flx* (1, 2, 3), flexures of ovary; *ov*, egg in uterus; *vlv*, vulva; *rud ov*, rudimentary posterior ovary; *trm*, terminus of ovary). O & P—*Cephalobus parvus*.

Subfamily Cephalobinae Filipjev, 1934

Diagnosis (emended).—Cephalobidae: Pharynx cephaloboid. Lips duplex or amalgamated, with inner circlet of papillae almost always located on outer contour of lips, not apical. Probolae or other cephalic appendages absent. Double flexure present in ovary posterior to vulva (except in occasional aberrant specimens). Spermatheca present at anterior flexure of female sexual apparatus. Nerve ring generally surrounding base of corpus. Accessory piece lineate. Striae 2μ or more apart.

Type genus.—*Cephalobus* Bastian, 1865.

Genus *Cephalobus* Bastian, 1865

Diagnosis (emended).—Cephalobinae: Wings extended to caudal terminus. Female tail blunt and rounded.

Type species.—*Cephalobus persegnis* Bastian, 1865. (loc. cit.)

Other species included.—

Cephalobus brevicaudatus Zimmerman, 1898

Cephalobus cornis (Thorne, 1925), n. comb.

Synonym.—*Acrobeles* (*Acrobeloides*) *cornis* Thorne, 1925

Cephalobus dubius Maupas, 1900

Cephalobus nanus deMan, 1880

Cephalobus strandi-cornutus Allgén, 1934

Cephalobus persegnis Bastian, 1865

Diagnosis (emended).—♀: 0.7-1 mm; a = 18-23; β = 4.-4.5; γ = 13.-16.; V—60.-63.

♂: 0.6-0.8 mm; a = 22; β = 4.3; γ = 15; T—55.

Lips low, rounded, obscurely duplex, the submedial asymmetrical. Esophagus almost cylindrical except in basal fifth where it tapers to the isthmus from which it is separated by only a break in the musculature. Female reproductive system typical (fig. 2, N). Female tail generally uniformly conoid to blunt terminus. Male tail more tapering, arcuate. Aberrant females from Oregon had slightly clavate tails (fig. 2, M & N).

Described from specimens collected in sugar-beet fields, Utah, and narcissus bulbs, Oregon.

Cephalobus parvus, n. sp. (fig. 2, O & P)

Diagnosis.—♀: 0.4 mm; a = 18; β = 3.3; γ = 12.5; V—^{16}68.^{18}

Lips completely amalgamated, rounded. Corpus of esophagus at first half as wide as neck, tapering in basal fourth to an obscure junction with the isthmus. Nerve ring at base of corpus. Excretory pore opposite nerve ring. Tail uniformly conoid to truncate terminus. Male unknown.

Habitat.—Pineapple field, Oahu, Hawaiian Islands. Grown on agar plate by Miss Juliette Oliveira.

Cephalobus parvus is distinctive because of its small size and form of lips and tail.

Genus *Eucephalobus* Steiner, 1936

Diagnosis (emended).—Cephalobinae. Wings extending only to phasmids. Female tails attenuated, acute (except *striatus*).

Type species.—*Eucephalobus oxyuroides* (deMan, 1876) Steiner, (1936, J. Helminth. Soc. Wash. 3:21).

Other species included.—

Eucephalobus bipapillatus (Stefanski, 1915), n. comb.

Synonym.—*Cephalobus bipapillatus* Stefanski, 1915

Eucephalobus bisimilis (Thorne, 1925), n. comb.

Synonym.—*Acrobeles* (*Acrobeloides*) *bisimilis* Thorne, 1925

Eucephalobus compsus (Steiner, 1935), n. comb.

Synonym.—*Neocephalobus compsus* Steiner, 1935

Eucephalobus elongatus (deMan, 1880), n. comb.

Synonyms.—*Cephalobus elongatus* de Man, 1880

Neocephalobus elongatus (deMan, 1880) Steiner, 1936

Eucephalobus latus (Cobb, 1906), n. comb.
Synonym.—Cephalobus latus Cobb, 1906
Eucephalobus multicinctus (Cobb, 1893), n. comb.
Synonym.—Cephalobus multicinctus Cobb, 1893
Eucephalobus mylakolaimus (Fuchs, 1930), n. comb.
Synonym.—Cephalobus mylakolaimus Fuchs, 1930
Eucephalobus nannus Steiner, 1936
Synonym.—Tricephalobus nannus (Steiner, 1936) Steiner, 1936
Eucephalobus striatus (Bastian, 1865), n. comb.
Synonyms.—Cephalobus striatus Bastian, 1865
Cephalobus bursifer deMan, 1876 (by deMan, 1884)

Eucephalobus oxyuroides (deMan, 1876) Steiner, 1936

Diagnosis (emended).—♀ : 0.65 mm; $a = 19$; $\beta = 3.9$; $\gamma = 8.3$; V—[14] 60.[14]
♂ : 0.55 mm; $a = 21$; $\beta = 3.5$; $\gamma = 11.6$; T—65.

These measurements and accompanying figures set forth all essential points of this species. Specimens collected by Dr. T. Goodey from material secured by Mr. W. E. H. Hodson at Broadmoor, Berks., England. A fairly common species in the United States (fig. 3, A-C).

Eucephalobus elongatus (deMan, 1880), n. comb.

Identity of this species has been confused by various writers. DeMan (1884, loc. cit. fig. 57, C) plainly shows the excretory pore anterior to the corpus base while (loc. cit. fig. 57) distinctly places the nerve ring slightly anterior to the excretory pore, surrounding base of corpus. These points, together with the deep pharynx and form of male tail (loc. cit. fig. 57, A-D) place the species in *Eucephalobus*. A composite of deMan's figures 57 and 57, C is shown (fig. 3, L).

Eucephalobus striatus (Bastian, 1865), n. comb.

Diagnosis (emended).—♀ : 0.55 mm; $a = 20$; $\beta = 4.1$; $\gamma = 9$; V—[19] 61.[21]
♂ : 0.5 mm; $a = 19$; $\beta = 3.9$; $\gamma = 12.5$; T—70.

Principal diagnostic features given in measurements and figures. Ventrosubmedial lips varying in asymmetry. Corpus of esophagus almost cylindrical then tapering gradually to an obscure junction with the isthmus. Isthmus length a little more than neck width. Nerve ring encircling base of corpus. Excretory pore opposite nerve ring (fig. 3, D-F).

Described from specimens secured by Dr. T. Goodey from material collected by Mr. W. E. H. Hodson, Broadmoor, Berks., England.

Eucephalobus latus (Cobb, 1906), n. comb.

Diagnosis (emended).—♀ : 0.6 mm; $a = 23$; $\beta = 3.9$; $\gamma = 8.1$; V—[20] 65.[15]
♂ : 0.5 mm; $a = 26$; $\beta = 3.6$; $\gamma = 10$; T—60.

Isthmus length equal to neck width. Nerve ring surrounding base of corpus. Excretory pore opposite nerve ring. Other characters as illustrated (fig. 3, M-O).

While these measurements do not correspond very well with those given by Cobb (1906, Expt. Sta. Bull. No. 5, Hawaiian Sugar Planters Assoc.), it is thought best to establish the species on the specimens at hand.

Specimens collected by Miss Oliveira, Oahu, T. H. Also found in soil from golden rod roots, Edison Experimental Farms, Fort Myers, Florida.

Eucephalobus laevis, n. sp. (fig. 3, G-K)

Diagnosis.—♀ : 0.7 mm; $a = 24$; $\beta = 3.9$; $\gamma = 11$-14; V—[17] 63.[16]
♂ : 0.7 mm; $a = 29$; $\beta = 4$; $\gamma = 15$; T—42.

Lips completely amalgamated, low, rounded, separated by deep axils. Prorhabdions usually cuticularized heavily at distal ends, appearing as forward pointing teeth. Details of esophagus, nerve ring and excretory pore shown in figure 3, J. Deirids opposite anterior end of isthmus. Female tail sometimes slightly longer, and terminus more obtuse, than figured.

Species distinctive because of lip region, esophagus form and location of nerve ring.

Habitat.—Alpine soil, Bald Mountain, Uintah Range, Utah. Elevation 11,947.

Eucephalobus teres, n. sp. (fig. 3, P & Q)

Diagnosis.—♀ : 0.74 mm; $a = 25$; $\beta = 4.1$; $\gamma = 11.1$; V—^{16} 62.^{13} Lips completely amalgamated, low, rounded. Esophagus: Isthmus length equal to neck width; corpus slender, cylindrical, 4½ times as long as isthmus. Nerve ring encircling corpus almost one neck-width above junction with isthmus. Excretory pore slightly posterior to nerve ring. Female tail conoid, acute, with terminus slightly bent ventrally. Male unknown.

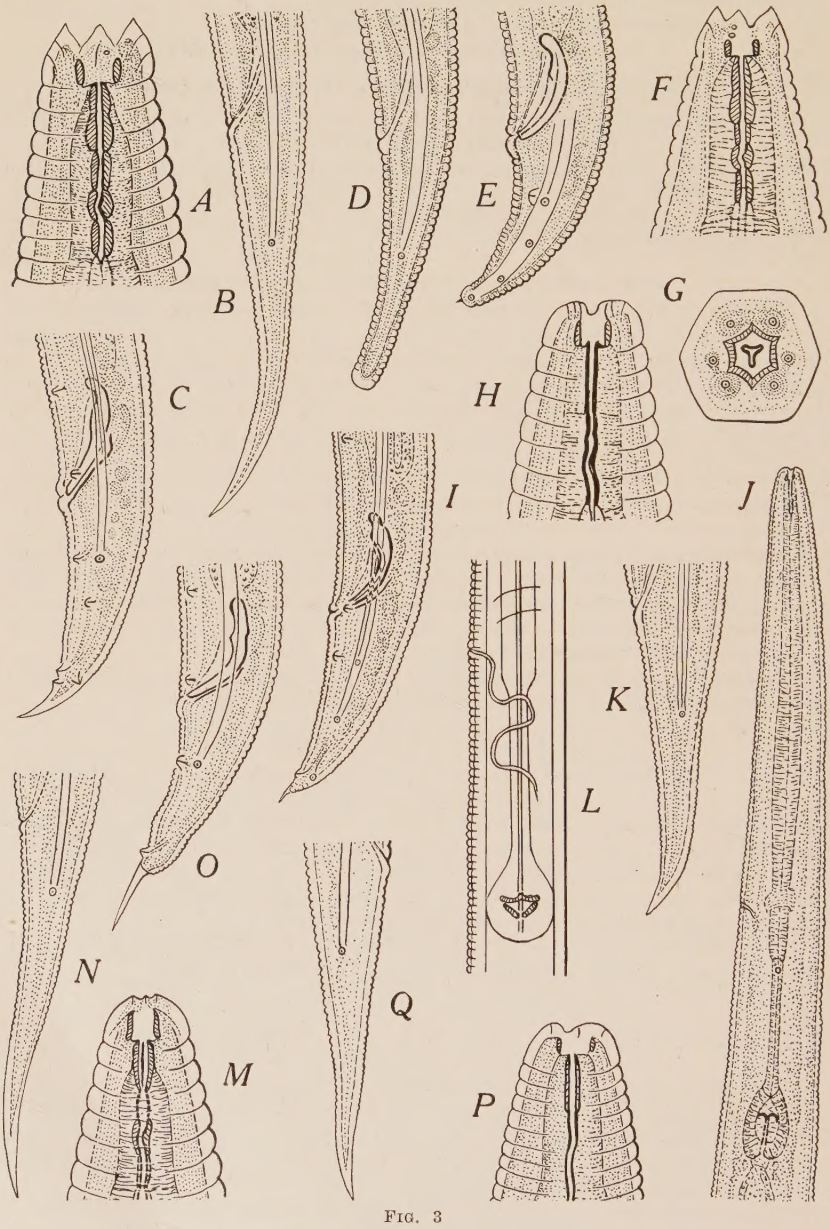

Fig. 3

A-C—*Eucephalobus oxyuroides*. D-F—*Eucephalobus striatus*. G-K—*Eucephalobus laevis*. L—*Eucephalobus elongatus*. M-O—*Eucephalobus latus*. P & Q—*Eucephalobus teres*.

Most resembling *Eucephalobus laevis* but the cephalic axils are shallower and less angular and the corpus of the esophagus is longer in proportion to the isthmus.

Habitat.—Decaying portion of King Alfred daffodil, infested with *Ditylenchus dipsaci* (Kühn, 1858); from Brookings, Oregon.

Acrobelinae, new subfamily

Diagnosis.—Cephalobidae: Lips bearing 3 labial and 6, generally distinct, cephalic, probolae. Pharynx cephaloboid. Ovary with double flexure posterior to vulva (except in occasional aberrant specimens). Spermatheca present at anterior flexure of female sexual apparatus. Accessory piece lineate. Annules coarse, 2μ or more wide.

Type genus.—*Acrobeles* von Linstow, (1877, Zool. Jahrb., Abt. System 3:2-3).

Genus *Acrobeloides* (Cobb, 1924), n. rank

Synonym—*Acrobeles* (s. g. *Acrobeloides*) Cobb, 1924.

Diagnosis (emended).—Acrobelinae: Labial probolae low, rounded. Cephalic probolae varying from rounded axil borders to distinct lobe-like or apiculate plates. Corpus of esophagus usually with elongate spindle-like swelling. Tails convex-conoid (except *clavicaudatus*) with 9 to 12 annules. Males very rare.

Type species.—*Acrobeloides bütschlii* (deMan, 1884) Steiner and Buhrer, 1933 (fig. 4, F).

Synonyms.—*Cephalobus persegnis* of Bütschli, 1873
Cephalobus bütschlii deMan, 1884
Acrobeles (*Acrobeloides*) *bütschlii* (deMan, 1884) Thorne, 1925

Other species included.—

Acrobeloides apiculatus (Thorne, 1925), n. comb.
Synonym.—*Acrobeles* (*Acrobeloides*) *apiculatus* Thorne, 1925

Acrobeloides bodenheimeri (Steiner, 1936), n. comb.
Synonym.—*Acrobeles bodenheimeri* Steiner, 1936

Acrobeloides clavicaudatus (Thorne, 1925), n. comb.
Synonym.—*Acrobeles* (*Acrobeloides*) *clavicaudatus* Thorne, 1925

Acrobeloides cubaënsis (Steiner, 1935), n. comb.
Synonym.—*Cephalobus cubaënsis* Steiner, 1935

Acrobeloides emarginatus (deMan, 1880), n. comb.
Synonym.—*Cephalobus emarginatus* deMan, 1880

Acrobeloides maximus (Thorne, 1925), n. comb.
Synonyms.—*Acrobeles* (*Acrobeloides*) *maximus* Thorne, 1925
Cephalobus maximus (Thorne, 1925) Steiner, 1935

Acrobeloides minor (Thorne, 1925), n. comb.
Synonyms.—*Acrobeles* (*Acrobeloides*) *minor* Thorne, 1925
Plectus obtusicaudatus Daday, 1899

Acrobeloides obliquus (Thorne, 1925), n. comb.
Synonym.—*Acrobeles* (*Acrobeloides*) *obliquus* Thorne, 1925

Acrobeloides tricornis (Thorne, 1925), n. comb.
Synonym.—*Acrobeles* (*Acrobeles*) *tricornis* Thorne, 1925

Placodira, new genus

Diagnosis.—Acrobelinae: Cuticle in plate-like segments over the anterior 12 to 16 annules. Labial probolae low, thick, rounded. Cephalic probolae lobe-like. Length of esophageal isthmus less than neck width; corpus slender, cylindrical. Nerve ring far forward surrounding corpus near beginning of its posterior third. Excretory pore near nerve ring.

Placodira appears most closely related to *Acrobeloides* from which it differs in the plated cuticle of the anterior region, very slender cylindrical corpus of esophagus, exceedingly short isthmus and position of nerve ring and excretory pore.

Type species.—*Placodira lobata*, n. sp.

Placodira lobata, n. sp. (fig. 4, A-E)

Diagnosis.— ♀ : 1.2 mm; $a = 22$; $\beta = 4$; $\gamma = 23$; V—[18] 65.[15]
♂ : 1.0 mm; $a = 28$; $\beta = 4$; $\gamma = 21$; T—45.

Characters of the genus as given above. Wing area one-fifth as wide as body near middle. Deirids located midway between bulb and nerve ring. Posterior uterine branch three times as long as body width.

Habitat.—Four males and one female from soil about roots of the creosote bush, *Covillea tridentata*, Littlefield, Arizona.

One specimen bore a parasitic growth, externally cup-like with hyphae extending into and along the neck (fig. 4, E).

Chiloplacus, new genus

Diagnosis.—Acrobelinae: Lip region tapering until less than half mid-body width. Labial probolae plate-like; at least the dorsal one furcate; the ventrosubmedial frequently asymmetrical to a degree that they are scarcely furcate (fig. 4, J). Cephalic probolae varying from rounded axil borders to distinct, flap-like, furcate, forward pointing processes. Corpus of esophagus slender, almost cylindrical except in its tapering posterior fourth; set off from the isthmus only by a break in the musculature. Tail of female slightly convex conoid or subcylindroid to bluntly rounded terminus, generally with 15 or more annules.

Type species.—Chiloplacus symmetricus (Thorne, 1925), n. comb.
Synonyms.—Acrobeles (*Acrobeloides*) *symmetricus* Thorne, 1925
Cephalobus symmetricus (Thorne, 1925) Steiner, 1935

Other species included.—

Chiloplacus bisexualis (Micoletzky, 1916), n. comb.
Synonyms.—Cephalobus lentus var. *bisexualis* Micoletzky, 1916
Cephalobus (*Acrobeles*) *bisexualis* (Micol. 1916) deMan, 1921
Acrobeles (*Acrobeles*) *bisexualis* (Micol. 1916) Thorne, 1925

Chiloplacus demani (Thorne, 1925), n. comb.
Synonyms.—Cephalobus (*Acrobeles*) *bisexualis* of deMan, 1921, not
Cephalobus (*Acrobeles*) *lentus* var. *bisexualis* (Micol., 1916) deMan, 1921
Acrobeles (*Acrobeles*) *demani* Thorne, 1925

Chiloplacus denticulatus (Thorne, 1925), n. comb.
Synonym.—Acrobeles (*Acrobeles*) *denticulatus* Thorne, 1925

Chiloplacus incurvus (Thorne, 1925), n. comb.
Synonym.—Acrobeles (*Acrobeles*) *incurvus* Thorne, 1925

Chiloplacus lentus Maupas, 1900
Synonyms.—Acrobeles (*Acrobeles*) *lentus* (Maupas, 1900) Thorne, 1925
Cephalobus lentus Maupas, 1900

Chiloplacus obtusicaudatus (Kreis, 1930), n. comb.
Synonym.—Acrobeles obtusicaudatus Kreis, 1930

Chiloplacus propinquus (deMan, 1921), n. comb.
Synonyms.—Cephalobus bütschlii of deMan, 1884
Cephalobus (*Acrobeles*) *propinquus* deMan, 1921
Acrobeles (*Acrobeloides*) *propinquus* (deMan, 1921) Thorne, 1925
Acrobeles (*Acrobeloides*) *contractus* Thorne, 1925
Cephalobus contractus (Thorne, 1925) Steiner, 1934

Chiloplacus quadricarinatus (Thorne, 1925), n. comb.
Synonym.—Acrobeles (*Acrobeles*) *quadricarinatus* Thorne, 1925

Chiloplacus trifurcatus (Thorne, 1925), n. comb.
Synonym.—Acrobeles (*Acrobeles*) *trifurcatus* Thorne, 1925

Chiloplacus truncatus (Thorne, 1925), n. comb.
Synonym.—Acrobeles (*Acrobeles*) *truncatus* Thorne, 1925

Zeldia, new genus

Diagnosis.—Acrobelinae: Cephalic axils dentate. Female tail convex-conoid to acute or subacute terminus. Labial probolae plate-like, low-rounded or furcate. Cephalic probolae thin, flap-like, acute. Nerve ring encircling base of corpus well above isthmus (*glaphyra?*). Excretory pore opposite nerve ring, farther forward than usual in Acrobelinae. (Named in honor of Mrs. Zelda Thorne.)

Type species.—*Zeldia punctata* (Thorne, 1925), n. comb.

Synonym.—*Acrobeles* (*Acrobeles*) *punctatus* Thorne, 1925

Other species included.—

Zeldia glaphyra (Steiner, 1935), n. comb.

Synonym.—*Acrobeles glaphyrus* Steiner, 1935

Zeldia punctulata (Thorne, 1925), n. comb.

Synonym.—*Acrobeles* (*Acrobeles*) *punctulatus* Thorne, 1925

Zeldia setosa (Cobb, 1914), n. comb.

Synonyms.—*Cephalobus setosus* Cobb, 1914

Acrobeles (*Acrobeles*) *setosus* (Cobb, 1914) Thorne, 1925

Cervidellus, new genus

Diagnosis.—Acrobelinae: Cuticle transversely striated only. Lip region about half as wide as mid-body width. Labial probolae slender furcate, "Y-shaped" occasionally with few branches. Cephalic probolae thin, flap-like, inward-pointing with plain or serrate-cuticularized borders. Small species generally less than 0.5 mm long.

Type species.—*Cervidellus cervus* (Thorne, 1925), n. comb.

Synonym.—*Acrobeles* (*Acrobeles*) *cervus* Thorne, 1925.

Other species included.—

Cervidellus ankyrus (Thorne, 1925), n. comb.

Synonym.—*Acrobeles* (*Acrobeles*) *ankyrus* Thorne, 1925

Cervidellus insubricus (Steiner, 1914), n. comb.

Synonyms.—*Cephalobus insubricus* Steiner, 1914

Acrobeles (*Acrobeles*) *insubricus* (Steiner, 1914) Thorne, 1925

Cervidellus kerguelensis (Steiner, 1916), n. comb.

Synonyms.—*Cephalobus vexilliger* var. *kerguelensis* Steiner, 1916

Acrobeles (*Acrobeles*) *vexilliger* var. *kerguelensis* (Steiner, 1916) Thorne, 1925

Cervidellus serratus (Thorne, 1925), n. comb.

Synonym.—*Acrobeles* (*Acrobeles*) *serratus* Thorne, 1925

Cervidellus serricephalus (Thorne, 1925), n. comb.

Synonym.—*Acrobeles* (*Acrobeles*) *serricephalus* Thorne, 1925

Cervidellus similis (Thorne, 1925), n. comb.

Synonym.—*Acrobeles* (*Acrobeles*) *similis* Thorne, 1925

Cervidellus vexilliger (deMan, 1880), n. comb.

Synonyms.—*Cephalobus vexilliger* deMan, 1880

Acrobeles (*Acrobeles*) *vexilliger* (deMan, 1880) Thorne, 1925

Cervidellus hamatus, n. sp. (fig. 4, K-M)

Diagnosis.—♀: 0.5 mm; $a = 15$; $\beta = 4$; $\gamma = 14$; V—[16] 64.[16] Cephalic probolae each with 3 slender membranes. Axils with basal membranes. Labial probolae doubly furcate, the 12 branches almost touching at their distal termini. Pharynx depth about equal to head width. Corpus about twice length of isthmus. Nerve ring near middle of isthmus. Excretory pore about opposite nerve ring. Body slightly constricted at vulva. Eggs twice as long as body width. Male unknown.

Slender membranes of the cephalic probolae and doubly bifurcate labial probolae distinguish this species.

Habitat.—Alpine soil, summit of Mount Deseret, Utah. Elevation 10,978.

Stegella, new genus

Diagnosis.—Acrobelinae: Cuticle divided into plate-like segments over entire body. Labial probolae furcate, the prongs simple or with a few branches. Cephalic probolae variable, rounded axil borders or flap-like with membranes. Wing area unusually broad with a medial line and crenate borders.

Type species.—*Stegella incisa*, n. sp.

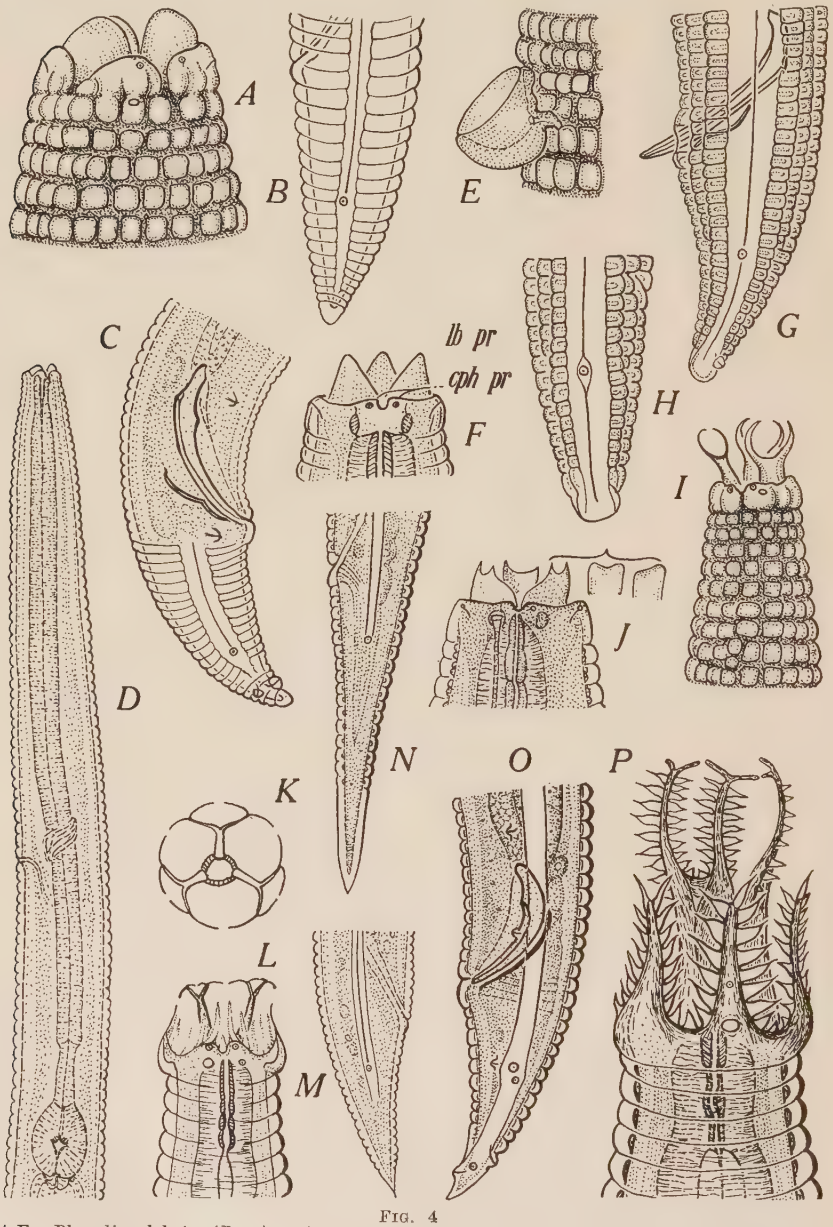

FIG. 4

A-E—*Placodira lobata* (D—Anterior end; X 425. E—Parasitic fungus growth on neck; X 2,000). F—*Acrobeloides butschlii*, ventrosubmedial view of head showing cephalic axils; *lb pr*, labial probolae; *ceph pr*, cephalic probolae. G-I—*Stegella incisa* (G—Male tail; X 1,000. H—Female tail; X 1,000). J—*Placodira symmetrica* (Note variations of ventrosubmedial labial probolae). K-M—*Cervidellus hamatus* (K—Face view of probolae). N-P—*Acrobeles ciliatus*.

Other species included.—
Stegella cancellata (Thorne, 1925), n. comb.
Synonym.—Acrobeles (Acrobeles) cancellatus Thorne, 1925
Stegella lineata (Thorne, 1925), n. comb.
Synonym.—Acrobeles (Acrobeles) lineatus Thorne, 1925

Stegella incisa, n. sp. (fig. 4, G-I)

Diagnosis.— ♀ : 0.5 mm; $a = 21$; $\beta = 3.6$; $\gamma = 15$; V—[17] 66.[17]
♂ : 0.46 mm; $a = 23$; $\beta = 4$; $\gamma = 13.5$; T—41

Characters of the genus. Lip region two-fifths width of neck base. Cuticle with 16 rows of plates at mid body. Cephalic probolae low, rounded, without processes. Labial probolae furcate about half their length, the prongs of each forming about three-fourths of a circumference. Corpus of esophagus slightly spindle-shaped, 3 times length of isthmus. Nerve ring at anterior end of isthmus. Excretory pore and deirids about opposite nerve ring. Spermatheca easily visible at anterior flexure of ovary. Egg length 3 times body diameter.

Habitat.—Soil about roots of shadscale, *Atriplex confertifolia*, Mosida, Utah.

Genus *Acrobeles* von Linstow, 1877

Diagnosis (emended).—Acrobelinae: Labial probolae deeply furcate and elaborately fringed. Cephalic probolae thin, forward pointing, acute, fringed. Tails of both sexes acute. Wing single, the area with crenate borders.

Type species.—Acrobeles ciliatus von Linstow, 1877 (loc. cit.).
Synonym.—Cephalobus ciliatus (von Linstow, 1877) deMan, 1884.
Other species included.—
Acrobeles cephalatus (Cobb, 1901) Thorne, 1925
Synonym.—Cephalobus cephalatus Cobb, 1901
Acrobeles complexus Thorne, 1925
Acrobeles crossotus Steiner, 1929
Acrobeles ctenocephalus Thorne, 1925
Acrobeles elaboratus Thorne, 1925
Acrobeles ornatus Thorne, 1925
Acrobeles serricornis Thorne, 1925
Acrobeles sinensis Kreis, 1930

Acrobeles ciliatus von Linstow, 1877

The original description and figures of this species are very meagre and actual determination of its identity is probably impossible. The following emended diagnosis is proposed in order to definitely establish the species.

Diagnosis (emended).— ♀ : 0.54 mm; $a = 15$; $\beta = 3.6$; $\gamma = 11.8$; V—[20]58.[18]
♂ : 0.53 mm; $a = 14$; $\beta = 3.6$; $\gamma = 13$; T—53.

Cuticle marked by about 175 coarse striae. Wing area about one-eighth of body width marked by 2 bright lines. Lip region expanded. Both labial and cephalic probolae with elaborate membranes, only half of which are illustrated (fig. 4, P). Amphid ovate, much more prominent than the papilla above it. Dorsal metarhabdion somewhat denticulate. Corpus of esophagus obscurely elongate spindle-shaped, its junction with the isthmus obscure. Isthmus length about equal to neck width with the nerve ring surrounding its anterior end. Excretory pore 1 or 2 body-widths anterior to nerve ring. Female sexual apparatus with distinct spermatheca and typical flexures. Length of posterior rudimentary ovary slightly greater than body width. Details of tails as illustrated (fig. 4, N & O).

Habitat.—Specimens secured by Dr. T. Goodey from soil collected by Mr. W. E. H. Hodson at Broadmoor, Berks., England.

Chambersiellinae, new subfamily

Diagnosis.—Cephalobidae: Lip region bearing 6 odontia and 6 cirri. Stomatorhabdions apparently panagrolaimoid. Cephalic papillae setose. Amphids one-fifth head width. Esophagus cephaloboid. Tail with hooked terminus.

Type genus and species.—Chambersiella rodens Cobb (1920, loc. cit.).

Species of Doubtful Position

Plectonchus coronatus Fuchs, 1930. Appears closely related to *Cervidellus* but lacks the furcate labial probolae.

Acrobeles variabilis Steiner, 1936. Labial probolae similar to those of *Acrobeloides*. Body much like that of *Eucephalobus*. Probably represents a new genus

Species Inquirendae

Cephalobus brachyurus Daday, 1908 (*Tricephalobus?* Median bulb figured)
Cephalobus filicaudatus Cobb, 1906 (Probably a *Prismatolaimus*)
Cephalobus gracilis Oerley, 1880
Cephalobus hawaiiensis Cobb, 1906 (*Tricephalobus?* Median swelling mentioned)
Cephalobus infestans Cobb, 1893
Cephalobus loczyi Daday, 1894
Cephalobus longicollis Daday, 1899
Cephalobus palustris Daday, 1908 (probably a *Plectus*)
Cephalobus persegnis var. *setifer* Fuchs, 1933
Cephalobus similis Cobb, 1893
Cephalobus stagnalis Daday, 1897
Cephalobus uncatus Daday, 1908 (figures referred to as *Plectus uncatus*)

Species Nomen Nudum

Cephalobus concavus Maupas, 1899. Name without description
Cephalobus contortus Steiner, 1935. Lapsus for *contractus*
Cephalobus truncatus Maupas, 1899. Name without description

Species Described as Cephalobidae, Transferred to Other Genera

Acrobeles armatus Kreis, 1929
Synonym.—Diploscapter coronata Cobb, 1913
Cephalobus alpinus Micoletzky, 1913
Synonym.—Aphelenchoides parietinus (by Micoletzky, 1922)
Cephalobus appendiculatus (Schneider, 1859) Oerley, 1885
A synonym of *Alloionema appendiculatum* Schneider, 1859

Notes on free-living and plant-parasitic nematodes, III. Gerald Thorne, U. S. Bureau of Plant Industry (Salt Lake City, Utah).

(1) two new species of aporcelaimus thorne and swanger, 1936

Aporcelaimus pachydermus, n. sp.

Diagnosis.—♀ : 4.7 mm; $a = 36$; $\beta = 5.1$; $\gamma = 100$; V—[17] 51.[17]
♂ : 4.8 mm; $a = 33.3$; $\beta = 5.6$; $\gamma = 83$

Cuticle occupying almost half the head width in latitude of spear. Aperture occupying five-sixths of spear length. Supplements located well in front of spicula, separated by spaces 2 to 3 times as wide as the supplements themselves. Spicula somewhat arcuate, very clavate with angular distal portions of the posterior segments (fig. 5, B *dst*).

General Description.—Cuticle with typical criss-cross markings and some radial striae at posterior extremities. A series of about 80 ventromedian papillae on both sexes, distributed throughout the length of the body but most closely arranged on neck where about 30 occur. A similar dorsomedian series, 11 on female, and 14 on male, are located between the head and nerve ring. Details of lips, amphids and spear shown in figure 5, A. Esophagus enlarged in posterior two-thirds until half the neck width; cardia hemispherical; intestine packed with fine granules. Female prerectum length equal to body diameter, male prerectum extending almost as far as supplement series. Details of posterior portion of male shown in figure 5, B.

Aporcelaimus pachydermus is distinctive because of the long spear aperture (similar to that of *A. regius*), arrangement of supplements (similar to those of *A. americanus*) and the slightly arcuate, clavate spicula with angular distal extremities of the posterior segments.

Two specimens, a male and female, were collected in Lincoln County, Miss.,

by W. F. Turner and submitted to the Division of Nematology by Dr. C. F. W. Muesebeck of the U. S. Bureau of Entomology and Plant Quarantine. Both specimens were somewhat shrunken so the neck measurements here given are shorter and the widths are greater than they actually are.

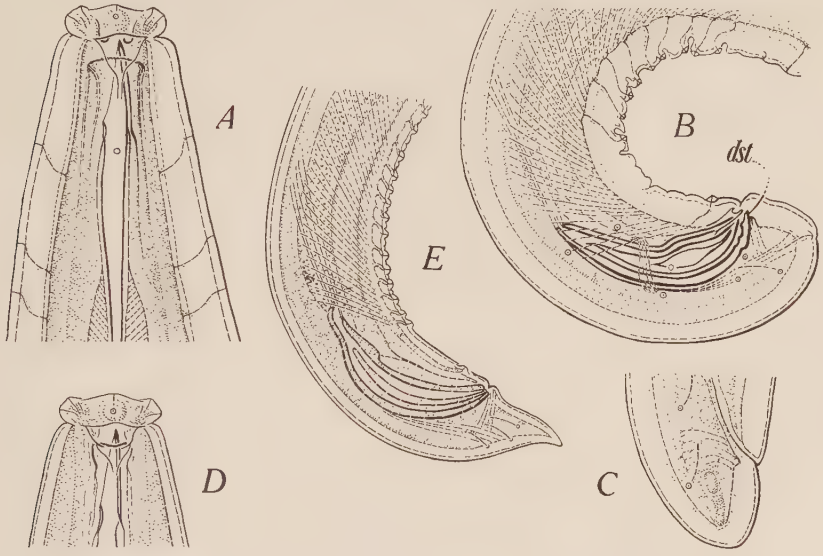

FIG. 5

A-C—*Aporcelaimus pachydermus* (A—Head, lateral view; X 500. B—Posterior portion of male; *dst*, angular distal portion of segment; X 165. C—Female tail; X 165). D & E—*Aporcelaimus cobbi* (D—Head; X 500. E—Male tail; X 165).

Aporcelaimus cobbi, n. sp.

Diagnosis.—♂ : 5.0 mm; $a = 43$; $\beta = 5$; $\gamma = 77$; testes 58% (fig. 5, D, E) Aperture occupying three-fourths of spear length. Male tail slightly digitate, the terminus recurved. Spicula somewhat arcuate with ventral angle anterior to middle. Supplements 17, the series beginning opposite ventral angle of spicula and extending over a distance equal to 2½ times the body width. Prerectum extending slightly past supplement series. Other characters similar to those of the genus. This species is distinctive because of the digitate male tail and arrangement of supplements.

Description derived from single male mounted in balsam by Dr. N. A. Cobb in 1887, from a collection made at Pompeii, Italy. When studied by the writer in 1931 the specimen was still in perfect condition.

(2) THE MALE OF APORCELAIMUS VORAX THORNE AND SWANGER, 1936

A single male of this species appeared in a collection from a sugar-beet field near West Jordan, Utah, being the only male observed among over 100 specimens. Length: 7.2 mm; $a = 59$; $\beta = 6.8$; $\gamma = 111$. Spear less angular than that described for the female by Thorne and Swanger (1936, Capita Zoologica, 6(4): 127, fig. 171). Spicula very similar in general form to those of *A. pachydermus* (fig. 5, C) but the distal extremities of the posterior spicula segments are not angular. Supplements 11, the series beginning one body width anterior to the spicula and extending over a space equal to two body widths. Prerectum extending slightly past supplement series.

(3) TYLENCHOLAIMUS ENSICULIFERUS COBB, 1893

From Cobb's (1893, Macleay Mem. Vol. Linn. Soc. N. S. Wales, pp. 252-308) description and figures it is obvious that this species is a *Xiphinema*. It is therefore renamed *Xiphinema ensiculiferus* (Cobb, 1893), n. comb.

(4) ANGUILLULA LINEA OKEN, 1815, IN GRUBE, 1849

Grube (1849, Archiv. Naturg. 15. J. 1:367,368, fig. 15-17) described a nema which the figures clearly indicate was a *Xiphinema*. The species is characterized by an elongated, digitate tail resembling that of *Dorylaimus bastiani*. Therefore this form becomes *Xiphinema linea* (Grube, 1849), n. comb., not *Anguillula linea* Oken, 1815.

Observations on a predaceous nematode. C. W. McBeth, U. S. Bureau of Plant Industry (Salt Lake City, Utah).

Bark from a pinyon pine, *Pinus edulus* Engelm, infested with a beetle, *Ips confusus* (Leconte), was collected near Tabiona, Utah, Nov. 12, 1936, by L. J. Farmer of the U. S. Forest Service. While examining this material, under water, several very active, free swimming nematodes were observed which proved to be *Aphelenchoides penardi* (Steiner, 1914), n. comb. One of these was found feeding on a larva of *Rhabditis obtusa* Fuchs. Upon being probed, the predator released his victim and began beating about vigorously for several minutes and then renewed his attack. Later the same nema was observed feeding on a smaller larva of *R. obtusa*. While feeding, *A. penardi* was very active and dragged his victim about.

Aphelenchoides penardi (Steiner, 1914), n. comb. (fig. 6, A-D)

Synonym.—*Aphelenchus penardi* Steiner, 1914

Description.— ♀ : 0.69 mm; $a = 31$; $\beta = 10$; $\gamma = 18$; V—^{37} 67.^{13}
♂ : 0.85 mm; $a = 43$; $\beta = 11$; $\gamma = 17$; T— 81

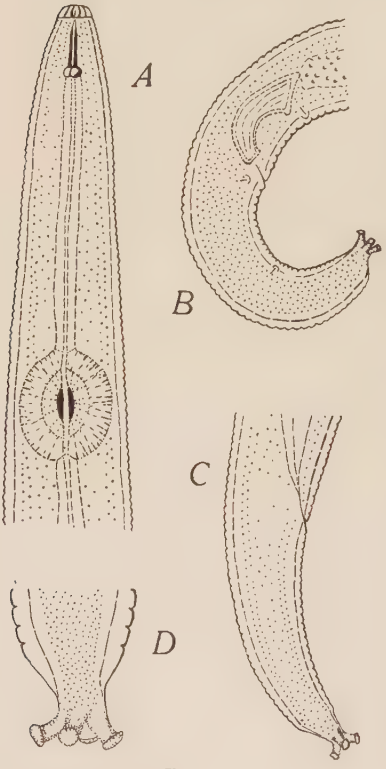

FIG. 6
Aphelenchoides penardi
A—Anterior end: X 750. B—Male tail; X 750. C—Female tail: X 750. D—Terminus showing sucker-like projections; X 2,000.

The above measurements correspond quite closely to those given by Steiner (1914, Arch. Hydrobiol. u. Planktonkunde 9(2):270). Spear strong with large basal knobs. Esophagus typical, bulb with distinct valves. Nerve ring about one bulb width behind bulb. Excretory pore just behind nerve ring. Spicula very blunt and massive, about one-third the body width. Posterior branch of uterus reaching about half way to anus. Four sucker-like projections on tail. Wing area one-fifth as wide as body, marked by two bright longitudinal lines. Three pairs of submedian papillae observed, one pair near middle of tail, one slightly behind anus and the third about one spicula length anterior to anus (fig. 6, B).

This is the first record of a predaceous *Aphelenchoides* in the United States, although Linford and Oliveira (in litt) observed two species of *Aphelenchoides* feeding on other nemas in Hawaii while cultured in agar.

Goodey (1928, J. Helminth. 6(3): 135), erroneously made *Aphelenchus penardi* Steiner, 1914, a synonym of *Aphelenchus parietinus* Bastian, 1865.

Parasites of *Amphiuma tridactylum*. H. J. Bennett and Joseph D. Re, Louisiana State University.

The parasites reported here were collected from 28 adult hosts examined at intervals from June, 1935, to June, 1936. The results give new distribution records for the forms found.

Cephalogonimus amphiumae Chandler, 1923, was found in the small intestine of 21 hosts, the infestation ranging from 3 to 308 specimens with a total of 1,101 being collected. Chandler (1923) describes this parasite from toto mounts and does not state whether a Laurer's canal is present. Serial sections of the present material were made and a Laurer's canal was found. It arises from the oviduct in common with the seminal receptacle and passes a short distance posteriorly and dorsally to terminate blindly beneath the median dorsal surface. That the present material is *C. amphiumae* is clearly indicated by its close agreement in every other respect with Chandler's description. Consequently, his description should be emended to include the presence of a Laurer's canal.

Halipegus fusipora (Guberlet, 1928), was found in the stomach of 5 hosts. The infestation ranged from 1 to 8 specimens, with a total of 21 being collected. Guberlet collected 3 specimens from the red-bellied water snake, *Farancia abacura*, all of which were fixed before being studied. The ovary was found immediately in front of the yolk glands in 2 of the specimens while in the other it was behind the glands. He points out that the discrepancy was probably due to contraction during fixation. The ovary in each of the present specimens is in front of the yolk glands so that is doubtless the normal position for this structure. The material agrees in every other detail with Guberlet's description.

The parasite has never been found in *F. abacura* nor in any other reptile examined by the writers. Its presence in a relatively high percentage of the *Amphiuma tridactylum* examined indicates that this amphibian is the normal host for this parasite in this vicinity.

Diplodiscus americanus (Chandler, 1923) was found in the rectum of 3 hosts. The infestation ranged from 1 to 11 specimens with a total of 15 being collected. Cort (1926) states that he considers the characters upon which the genus *Megalodiscus* Chandler, 1923, is based to be insufficient and Hunter (1930) reduces the genus to synonymy with the genus *Diplodiscus* Diesing, 1836. The writers are also of the opinion that the genus *Megalodiscus* should be considered as a synonym of *Diplodiscus*.

Cercorchis amphiumae (Chandler, 1923) was found in the small intestine of 6 hosts. The infestation ranged from 1 to 3 specimens with a total of 10 being collected. Chandler places this species in the genus *Telorchis* Looss, 1899. Perkins (1928) discusses the subfamily Telorchinae Looss, 1899 and raises the subgenus *Cercorchis* Lühe, 1900 to generic rank. Bennett (1935) accepts this elevation of the subgenus and describes *Cercorchis singularis* as a new species for the genus. The writers are of the opinion that the parasite under discussion should be transferred from the genus *Telorchis* to the genus *Cercorchis*.

Two immature specimens of the cestode *Ophiotaenia* sp. were found in a single host in addition to the trematodes listed above.

A new trichostrongyle, *Allintoshius nycticeius*, n. g., n. sp., (Nematoda) from a bat. B. G. Chitwood, U. S. Bureau of Animal Industry.

The nematode described in this paper was collected by Mr. Allen McIntosh from the intestine of a bat, *Nycticeius humeralis*, taken at Washington, D. C. This nematode represents apparently a new genus and species of trichostrongyle for which the name *Allintoshius nycticeius* is proposed.

Allintoshius, new genus

Diagnosis.—Ollulaninae: Oral opening rounded, lips absent; cephalic papillae consisting of an internal circle of 6 small papillae and an external circle of 4 (?) papillae. Stoma rudimentary, dorsal tooth absent. Cephalic inflation not collarlike, asymmetric (fig. 7); spines absent. Deirids not observed; alae absent; longitudinal ridges numerous, conspicuous. Male with short unstriated conoid spicules;

gubernaculum present. Bursa large, dorsal lobe nearly as long as, but not set off from, lateral lobes; ventral accessory bursal lobe present. Rays all well developed, elongated. Female with 2 ovaries; oviparous; tail elongated, subcylindrical, bearing 1 elongated caudal process and 2 minute mucrones.

Type species.—*Allintoshius nycticeius,* new species

Allintoshius nycticeius, new species

Description.—Male 2.58 to 2.65 mm long by 66 to 85μ wide. Esophagus 200 to 230μ long. Spicules 103 to 108μ long. Bursal formula: Ventroventral and lateroventral rays parallel, separated; externolateral and mediolateral rays close together, diverging near tip; dorsolateral ray separate from other laterals to trunk; externodorsal rays originating near base of dorsal trunk; dorsal ray terminating in 4 small digitations. Female 5.25 mm long by 100μ wide; esophagus 316μ long; tail 150μ long; vulva dividing body in proportion of 78:22; eggs 85 to 90μ long by 33 to 37μ wide.

Host.—*Nycticeius humeralis.*

Location.—Intestine.

Locality.—Washington, D. C., U. S. A.

Specimens.—U. S. N. M. Helm. Coll. No. 42464 (cotypes).

The genus *Allintoshius* appears to be closely related to *Bradypostrongylus* Price, 1928 (Proc. U. S. Natl. Mus., 73 (4): 1-7, pls. 1-2) but differs from that genus in type of spicules and in character of dorsal ray. In *Allintoshius* the spicules are of a setaceous conoid form, while in *Bradypostrongylus* they are of a complex twisted filamentous type. The dorsal ray of *Allintoshius* bears 2 pairs of small digitations instead of being cleft with each branch bifurcating as in *Bradypostrongylus.*

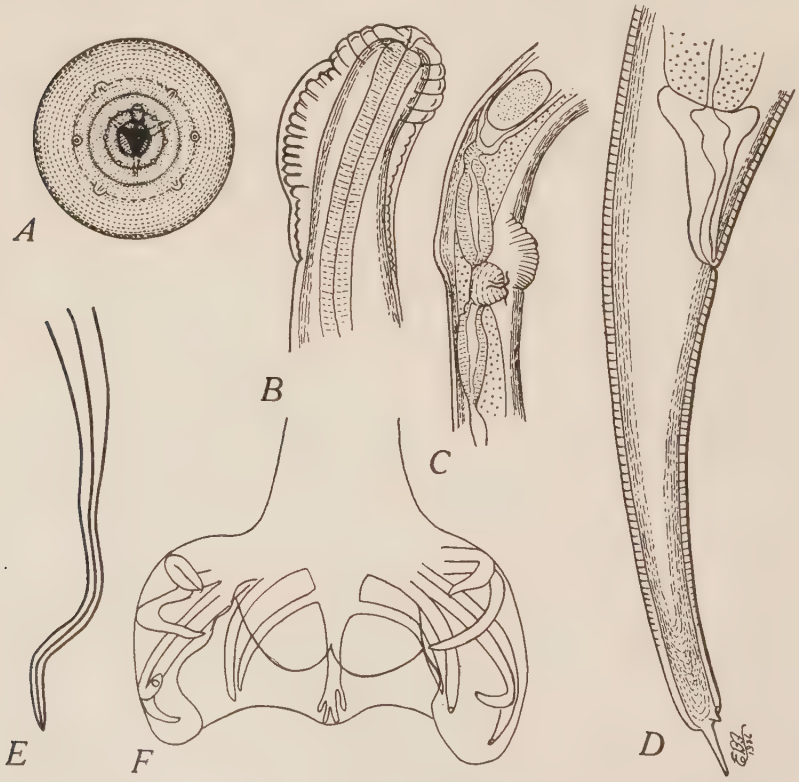

Fig. 7
Allintoshius nycticeius
A—Head, en face view. B—Head, side view. C—Vulvar region. D—Female tail. E—Spicules. F—Male tail, ventral view.

Two new avian liver flukes with a key to the species of the genus *Athesmia* Looss, 1899 (Dicrocoeliidae). Allen McIntosh, U. S. Bureau of Animal Industry.

In this paper two new species of trematodes belonging to the genus *Athesmia* Looss, 1899 are described. The first of these, for which the name *A. wehri* is proposed, was collected on November 10, 1931, by Dr. E. E. Wehr from a sharp-tailed grouse, *Pedioecetes phasianellus campestris* Ridgway, at Ft. Keogh, Miles City, Montana. The second species, for which the name *Athesmia pricei* is proposed, was collected by Dr. E. W. Price from a green backed trumpeter, *Psophia viridis* Spix, a Brazilian bird which died May 28, 1930, in the National Zoological Park, Washington, D. C.

Athesmia wehri, n. sp.

Description.—Body elongate (fig. 8, A) with slightly tapering extremities, semitransparent, 9.85 mm long by 1.52 mm wide, and 150μ thick. Dorsal and ventral surfaces slightly convex; cuticle without spines. Oral sucker subterminal, 450μ long by 550μ wide; acetabulum 420μ in diameter, smaller than oral sucker, removed from anterior end by a distance equal to about maximum width of body. Pharynx spherical, about 120μ in diameter; esophagus 300μ long, with intestinal fork slightly nearer to oral sucker than to acetabulum; intestinal branches slightly undulating, ending about midway between level of posterior extremity of vitellarium and caudal end of body. Excretory system Y-shaped, dorsal to uterus; the sigmoid bladder forking at a distance from the posterior end equal to about ⅜ of body length; after forking the right and left stems proceed along mesal margins of intestinal branches to level of posterior testis where each stem divides into an ascending branch and a descending branch. The ascending branch of each side continues along the mesal margin of the intestine to near the posterior level of the cirrus sac where it crosses the intestinal tract ventrally, dividing into an apparently undivided anterior branch extending to the oral sucker and a forked posterior branch sending its limbs into the area surrounding the acetabulum. The descending branch of each side immediately crosses the intestine ventrally and proceeds along the lateral margin of the intestine to a point near the level of the ovary where it divides into (1) a forked short stem mesal branch sending its limbs into the area surrounding the ovary and (2) a forked long stem posterior branch sending one limb mesad and the other posteriad. None of the tubules could be followed to the flame cells, and it was not possible to determine whether or not further division takes place. Anterior testis 600μ long by 600μ wide, irregular in outline, deeply fissured laterally, situated on same side of body as vitellarium; posterior testis 650μ long by 930μ wide, deeply fissured and irregular in outline, wider and somewhat larger than anterior testis, occupying entire width of intercecal field; vasa efferentia appear to unite dorsal to acetabulum; cirrus sac spindle-shaped, about 400μ long by 140μ in diameter, containing seminal vesicle and cirrus, the latter projecting about 250μ in type specimen. Genital pore median immediately posterior to fork of intestine. Ovary 300μ long by 680μ wide situated equatorially and submedially with numerous lobes extending in all directions. The oviduct arises from the posterior margin of the ovary and leads into a spindle-shaped fertilization chamber; from the fertilization chamber Laurer's canal is given off, which curves around the mesal margin of the ovary and opens dorsally; the fertilization chamber gives off a slender duct which is joined by the single vitelline duct just before reaching the ootype; a comparatively large well-defined seminal receptacle, 260μ long and 380μ wide, lies posterior and dorsal to the ovary; on the ventral surface of the receptable is a connection with the fertilization chamber. The ovarian complex is very much like that figured by Jacoby (1899, Arch. Naturg. 66, J., 1 (1):1-30, pls. 1-2, figs. 1-16) for *Distomum hetero-lecithodes* Braun. Vitellarium consisting of numerous follicles extending through an area 2.6 mm long by 200μ to 300μ wide, posterior to, and on opposite side of body from, ovary. Uterus with numerous coils, extending first posteriorly to end of body, usually crossing over to the opposite side near level of fork of excretory bladder and proceeding to posterior end of body, the ascending portion passing between vitellarium and ovary and dorsal to posterior testis, then lateral to an-

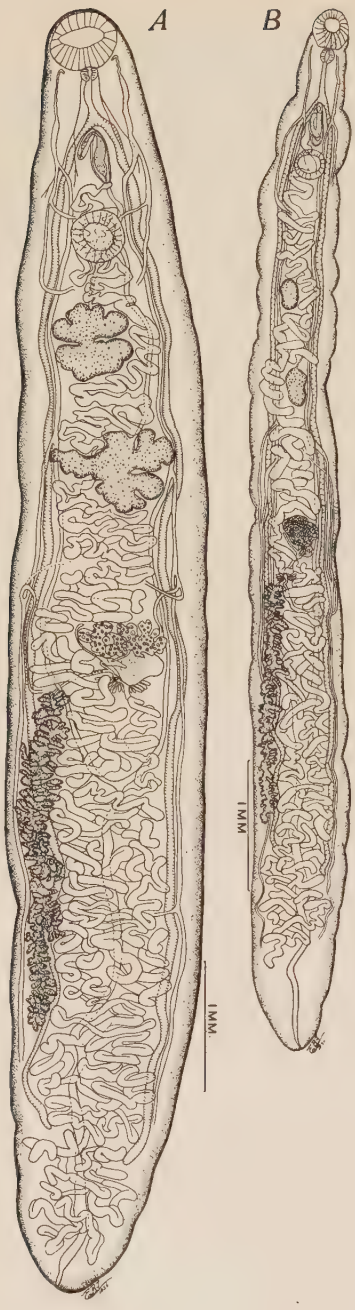

Fig. 8

A—*Athesmia wehri*, n. sp., ventral aspect. B—*Athesmia pricei*, n. sp., ventral aspect.

terior testis, and finally dorsal to acetabulum and cirrus sac to genital pore. Eggs 32μ by 20μ, those of upper part of ascending portion of uterus dark brown in color, while those in the beginning portion are lighter in color.

Habitat.—Liver (?) of *Pedioecetes phasianellus campestris* Ridgway.

Locality.—Ft. Keogh, Miles City, Montana, U. S. A.

Specimens.—U. S. National Museum Helm. Coll. No. 43068 (type) and No. 40971 (paratypes).

The material, 2 complete and 4 mutilated specimens, on which the description of this species is based was collected, according to the label, from the "intestine" of a bird that had been shot. However, the collector has informed the writer that they were found in the washings of the intestines and may have escaped from the liver, the normal habitat of other members of the genus *Athesmia*.

Athesmia pricei, n. sp.

Description.—Body slender (fig. 7, B), 8 mm long by 700μ wide and 140μ thick; cuticle without spines. Oral sucker 320μ long by 270μ wide, with subterminal opening; acetabulum 230μ in diameter, situated about 1/7 of body length from anterior end. Pharynx 100μ in diameter; esophagus 300μ long, forking about midway between the two suckers; intestinal ceca slender, simple, unequal in length, extending posteriorly about 120μ from margin of body and ending slightly posterior to level of caudal extremity of vitellarium. Excretory system, as far as could be observed, simliar to that of *Athesmia wehri*. Anterior testis 230μ long by 130μ wide, almost oval in outline, removed from acetabulum by a distance equal to that separating posterior testis and ovary; posterior testis 280μ long by 175μ wide, similar in shape to anterior testis, and situated nearer to anterior testis than to ovary; cirrus sac about 280μ long by 120μ wide, containing coiled seminal vesicle and cirrus with tip only of latter projecting through the genital pore which is located immediately posterior to intestinal fork. Ovary oval or only slightly lobed, 240μ by 280μ in diameter, equatorial; seminal receptacle small, 100μ by 130μ in diameter, posterior and dorsal to ovary; Laurer's canal present; Mehlis' gland somewhat lateral, with lateral half immediately in front of vitellarium. Vitellarium posterior to, and on opposite side of body from ovary, the

follicles extending through an area 1.85 mm long by 130μ to 150μ wide; distance from posterior extremity of vitellarium to caudal end of body slightly less than length of vitellarium. Uterus with numerous coils, extending to within a short distance of the posterior end; descending portion crossing ascending portion in the posterior half of the body 3 to 4 times. Ascending portion returning in space not occupied by descending portion as far as level of ovary, passing between ovary and vitellarium, then continuing between the testes and dorsal of the acetabulum and cirrus sac to genital pore. Eggs 32μ by 19μ, from light lemon to dark brown in color.

Habitat.—Liver of *Psophia viridis* Spix.

Locality.—National Zoological Park, Washington, D. C., U. S. A.

Specimens.—U. S. N. M. Helm. Coll. No. 43069 (type) and No. 29761 (paratypes).

This species is based on 2 complete and 10 mutilated specimens collected from the bile ducts. As previously noted, the bird from which these specimens were obtained is a native of South America and probably was infected before its arrival at the Park.

The genus *Athesmia* belongs to the family Dicrocoeliidae Odhner, 1910, and was proposed by Looss, 1899, for a single species, *Distomum heterolecithodes* Braun, 1899. Braun's material was from the liver of a bird, *Porphyrio porphyrio,* from Madagascar. In the same year Jacoby (1899, Zool. Anz. (591) 22:300) reported finding this parasite in another bird, *Gallinula chloropus,* from East Prussia. In 1911, Goldberger and Crane described a second species, *Athesmia foxi,* from the liver of a monkey *Cebus capucinus,* from South America, and in 1917, Travassos described a third species, *Athesmia attilae,* from the liver of a bird, *Attila cinerea,* from Brazil. Of the five species belonging to the genus *Athesmia,* only one, *A. wehri,* is known to occur in the United States.

The differential characters of these species are brought out in the following key:

1. Ovary in anterior half of body; vitellarium longer than distance from ovary to acetabulum ..... *A. heterolecithodes* (Braun)
   Ovary equatorial or approximately so; vitellarium shorter than distance from ovary to acetabulum 2

2. Intestinal ceca terminating near or before reaching level of caudal extremity of vitellarium ..... *A. foxi* Goldberger and Crane
   Intestinal ceca terminating some distance posterior to level of caudal extremity of vitellarium 3

3. Testes oval or only slightly lobed; smaller than ovary ..... *A. pricei,* n. sp.
   Testes deeply lobed; larger than ovary 4

4. Ovary smooth ..... *A. attilae* Travassos
   Ovary greatly lobulated ..... *A. wehri,* n. sp.

A new trematode, *Postharmostomum noveboracensis,* n. sp. (Brachylaemidae), from a chipmunk. Allen McIntosh, U. S. Bureau of Animal Industry.

Recently a single specimen of an apparently new trematode belonging to the family Brachylaemidae was obtained from the small intestine of a chipmunk, *Tamias striatus lysteri,* that had been preserved in alcohol since 1896; this host animal was collected in the Catskill Mountains, New York.

Postharmostomum noveboracensis, n. sp.

Description—Body oblong (fig. 9), 1.36 mm long, 650μ wide and 100μ thick; cuticle beset with numerous spines. Oral sucker depressed, with oval opening,

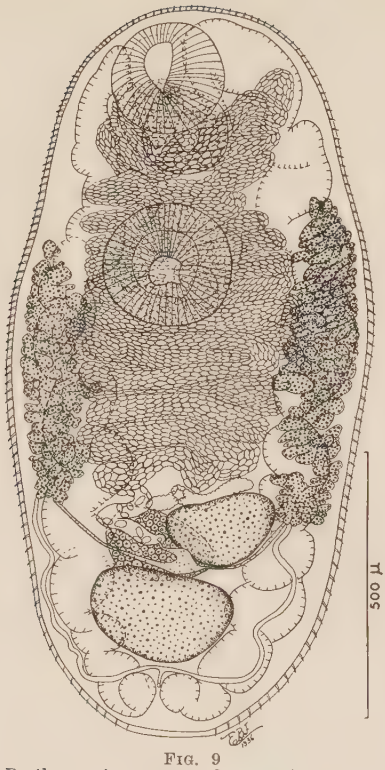

Fig. 9
Postharmostomum noveboracensis, n. sp., ventral aspect.

subterminal, 200μ in diameter. Pharynx 150μ in diameter. Intestinal crura comparatively broad, with serpentine coils, extending to posterior end of body. Acetabulum 230μ in diameter, situated about one-third of body length from anterior end. Excretory pore subterminal and ventral; excretory bladder short, dividing into two ectosiphons which could be followed only a short distance. Gonads in triangular arrangement, located in posterior third of body, with ovary opposite interval separating the testes; anterior testis sinistral, 120μ long by 200μ wide. Posterior testis medial, 160μ long by 265μ wide. Seminal vesicle anterior to anterior testis. Genital pore median, at beginning of posterior third of body and near level of anterior margin of anterior testis. Ovary dextral, 120μ long by 200μ wide. Oviduct, Mehlis' gland and fertilization chamber ventral to ovary; Laurer's canal opening to surface dorsal to posterior testis. Vitellaria asymmetrical, extending from level of anterior testis into and through zone of acetabulum; vitelline ducts at level of posterior margin of anterior testis, uniting to form vitelline reservoir ventral to ovary. Uterus filling most of intercecal space from region of gonads to oral sucker; coils of uterus difficult to follow. Eggs 26.5μ by 14.5μ.

Habitat.—Intestine of *Tamias striatus lysteri.*
Locality.—New York, U. S. A. (Catskill Mountains).
Type specimen.—U.S.N.M.—Helm. Coll. No. 43075.

This species may be easily separated from *Postharmostomum laruei* McIntosh, 1934, described from the same host species from Michigan, by the cuticle which is spiny in *P. noveboracensis* and smooth in *P. laruei.* It may be further differentiated from *P. laruei* by the shape of the gonads, the margins of these organs being irregular in outline in *P. laruei* and smooth in *P. noveboracensis.*

A species of Orthoptera serving as intermediate host of *Tetrameres americana* of poultry in Puerto Rico. Eloise B. Cram, U. S. Bureau of Animal Industry (Transferred to National Institute of Health).

In the course of a study of poultry parasites in Puerto Rico during the winter of 1935-36, specimens of grasshoppers collected at Mayaguez were fed eggs of the nematode *Tetrameres americana,* originating from heavy infestations of the proventriculus of chickens; it was found that the larvae developed in the body tissues of the insects to the characteristic third stage. Feeding of these larvae to incubator-hatched, laboratory-reared chicks led to development of the adult nematodes in the proventriculi of the chickens. The Orthoptera were later identified as a species of Acrididae, namely, *Scyllina cyanipes* (Fabr.), by A. B. Gurney of the U. S. Bureau of Entomology and Plant Quarantine, Washington, D. C.; this finding constitutes a new species of intermediate host for this parasite. Attempts to infect the "changa," or West Indian mole cricket (*Scapteriscus vicinus*), and a cockroach (*Periplaneta australiana*) were unsuccessful.

Redescriptions of two exotic species of monogenetic trematodes of the family Capsalidae Baird from the MacCallum Collection. EMMETT W. PRICE, U. S. Bureau of Animal Industry.

Among the numerous species of monogenetic trematodes described by the late Dr. G. A. MacCallum were two exotic forms, *Encotyllabe pagrosomi* and *Acanthocotyle squatinae,* belonging to the family Capsalidae Baird. On comparing the specimens of these forms with the original descriptions it was found that certain omissions and errors had been made, and that the latter species belongs to the genus *Trochopus* Diesing instead of *Acanthocotyle* Monticelli. In this paper are presented new descriptions and illustrations of these species so as to make it possible to compare them with the other species of their respective genera.

Encotyllabe pagrosomi MacCallum, 1917

Description.—Body elongate (fig. 10, A), 5 to 5.4 mm long by 1.4 mm wide, disregarding infolded margins. Anterior haptors sucker-like, elliptical, 255μ wide, surrounded by a fan-like membrane 510 to 680μ across. Posterior haptor pedunculated, campanulate, 768 to 935μ in diameter, surrounded by a delicate marginal membrane 85μ wide, and armed with one pair of large hooks, one pair of small hooks and a number, probably 14, of marginal hooklets. Large hooks (fig. 10, B, 1) 360 to 380μ long by 152 to 172μ wide at base, tips recurved; small hooks (fig. 10, B, 2) about 30μ long, postero-lateral to large hooks; marginal hooklets about 15μ long, situated at junction of marginal membrane and muscular portion of haptor. Oral aperture ventral, median, about 500μ from anterior end of body. Pharynx more or less globular, about 340μ in diameter. Two pairs of eyes present, antero-dorsal to oral aperture. Genital aperture sinistral, at level of middle of pharynx and about midway between pharynx and margin of body. Cirrus pouch elliptical, its base lying in median line posterior to pharynx. Testes oval, unequal, preequatorial; right testis 425 to 510μ long by 255μ wide; left testis 390 to 425μ long by 255μ wide. Ovary oval, 340μ by 255μ, median, immediately pretesticular. Vitelline follicles extending from level of posterior end of pharynx to base of pedicle of haptor. Vagina present, apparently very short, its aperture situated slightly to left of anterior margin of vitelline reservoir. Ootype not conspicuous, posterior to cirrus pouch; metraterm slender. No eggs present.

Host.—Pagrosomus auratus (Houttuyn).

Location.—"Mouth and throat."

Distribution.—Australia.

Specimens.—U. S. N. M. Helm. Coll. No. 35638 (cotypes), collected by Dr. W. G. MacCallum, April 12, 1916, at Sydney, Australia.

The original description given by MacCallum (1917, Zoopathologica, 1(2), 50-53) was more or less general in nature and the measurements differ slightly from those given by the present writer. The figure accompanying the original description was, as MacCallum pointed out, a composite one, the outlines of the body being from a ventral view of one specimen and the details from a dorsal view of another specimen. The female aperture was shown as distinct from the male aperture, but actually the genital ducts open to the exterior through a common pore. The large haptoral hooks are somewhat different from those shown in the original figure, the tips being shorter and blunter; the small hooks were overlooked entirely, as were the marginal hooklets. In this connection it may be noted that the marginal hooklets of the haptors in members of the family *Capsalidae* have generally been overlooked, but since the writer has found them to be present in all members of the genera *Capsala, Tristoma, Trochopus, Nitzschia, Ancyrocotyle, Entobdella, Benedenia* and *Encotyllabe* examined, it may be assumed that they are present in all species of these genera.

A vagina appears not to have been described in any of the species of *Encotyllabe* except *E. spari* Yamaguti. However, the writer finds this structure to be present in *E. pagrosomi* MacCallum, as well as in *E. lintonii* Monticelli, and it seems safe to conclude that it is present in the other members of the genus as well.

Trochopus squatinae (MacCallum, 1921), new comb.

Synonym.—*Acanthocotyle squatinae* MacCallum, 1921.

Description.—Body elliptical (fig. 10, C), 2.9 to 3.5 mm long by 1.3 to 1.5 mm wide. Anterior end with hood-like ridge bearing 2 elliptical sucker-like haptors 95μ long by 172μ wide. Posterior haptor disc-like, 544 to 599μ in diameter, with festooned marginal membrane 47 to 57μ wide; ventral surface bearing 7 radial septa, the postero-lateral trifid, with 2 incomplete septa extending inward from margin subdividing posterior marginal area, and with an incomplete septum incompletely dividing each of the anterior marginal areas. Three pairs of large haptoral hooks present (fig. 10, D), those of first pair robust, 143 to 148μ long, those of second pair slender, 42μ long, tips recurved and pointed, and those of third

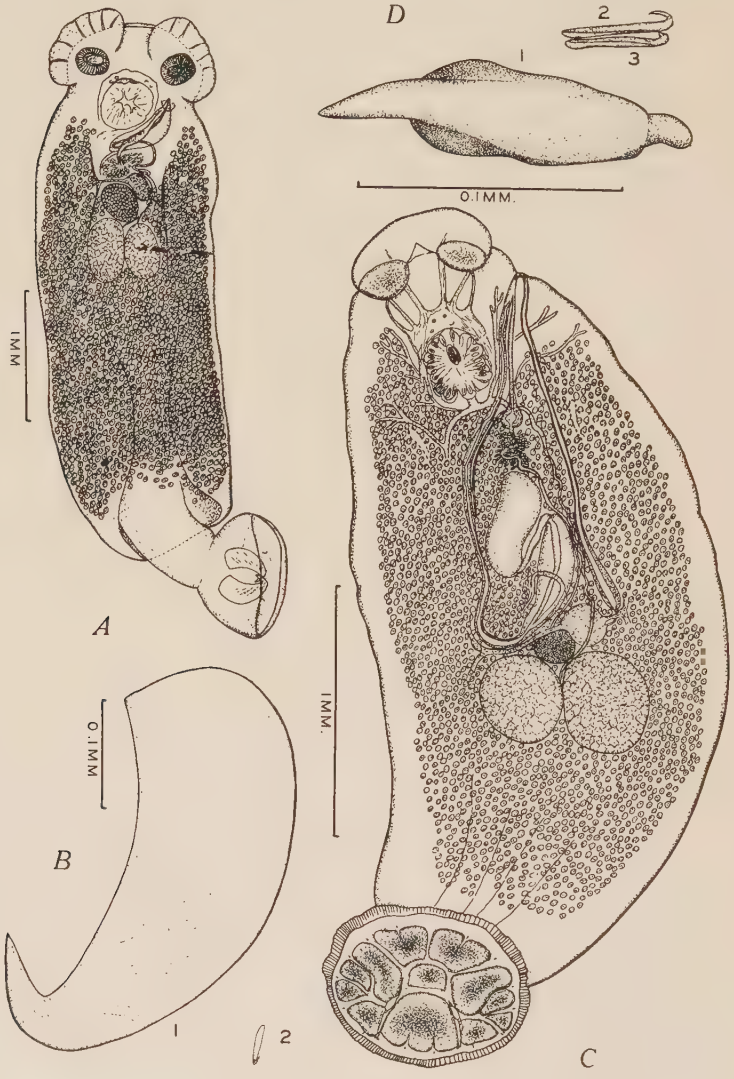

Fig. 10

A & B—*Encotyllabe pagrosomi* (A—Complete specimen, ventral view. B—Hooks from haptor, (1) large hook and (2) small hook). C & D—*Trochopus squatinae* (C—Complete specimen, ventral view. D—Hooks from haptor, (1) large hook, (2 & 3) small hooks).

pair slender, 24 to 38μ long, tips slightly recurved and blunt. Marginal hooklets 14 in number, situated at intervals at junction of marginal membrane and haptor. Oral aperture median, about 600μ from anterior end of body. Pharynx 266μ in diameter; esophagus very short; intestinal limbs with lateral and median dendritic branches. Eyes present, two pairs, antero-dorsal to oral aperture. Genital aperture marginal, about 140μ posterior to anterior margin of left anterior haptor; genital atrium relatively short and narrow. Cirrus pouch very long and slender, extending diagonally across body to right of median line as far as level of ovary, then turning anteriad, its base lying to left of median line and directed anteriorly; prostatic reservoir lying in median field, partly to one side of base of cirrus pouch and connected to it by a slender duct; cirrus very long and slender. Testes globular or slightly oval, slightly unequal, postequatorial; right testis 340μ in diameter, left testis 400μ long by 340μ wide. Vas deferens long and slender, running anteriad, between vagina and base of cirrus pouch to level of ootype, then turning and extending posteriad parallel to cirrus. Ovary globular, 190μ in diameter, median, immediately pretesticular. Vitelline follicles occupying greater part of body from level of oral aperture to near posterior end of body proper. Vagina long and slender, its base expanded and lying at level of vitelline reservoir, and opening immediately posterior to genital aperture. Ootype piriform, to left of median line; metraterm slender. Egg triangular, 120μ wide, with slender filament.

Host.—*Squatina squatina* (Linn.).

Location.—Gills.

Distribution.—Federated Malay States.

Specimens.—U. S. N. M. Helm. Coll. No. 7749 (cotypes); collected at Singapore, July 16, 1916, by Dr. W. G. MacCallum.

The description and figure of this species as given by MacCallum (1921, Zoopathologica, 1:152-156) is fairly accurate so far as external characters are concerned, but entirely erroneous as regards internal structure. According to MacCallum, "The vasa deferentia pass forward widely separated in the center of the worm, but join together a short distance posterior to the angle of division of the coeca. They terminate in the cirrus, which proceeds past the side of the pharynx to the cloaca or genital pore on the left side of the neck of the worm." A careful study of the cotype specimens shows that what he thought were the "vasa deferentia" were the cirrus pouch and parts of the vagina and vas deferens, the right duct being the cirrus pouch and the left the base of the vagina as far as the level of the base of the cirrus pouch and from there on the vas deferens. It is difficult to understand why this error occurred unless his description was based on the artist's sketch instead of on a study of the specimens. The base of the cirrus pouch was referred to as the seminal receptacle, and the prostatic reservoir as the uterus. Other errors were made in the original description but an enumeration of them here appears unnecessary.

The assignment of this species to the genus *Acanthocotyle* was evidently unintentional, since the resemblance between that genus and *Trochopus* is not very striking.

A new monogenetic trematode from Alaskan salmonoid fishes. Emmett W. Price, U. S. Bureau of Animal Industry.

Recently the U. S. Forest Service forwarded to the Bureau of Animal Industry a number of fishes to be examined for parasites. These fishes had been collected by Mr. W. A. Chipperfield in Sitkoh Bay, Alaska, and consisted of six specimens of Alaskan cutthroat trout (*Salmo mykiss*), 57 specimens of Dolly Varden trout (*Salvelinus malma spectabilis*), and one young silver salmon (*Oncorhynchus kisutch*). These fishes were examined by Mr. C. H. Hill of the Zoological Division and the gills of all of the cutthroats, one of the Dolly Vardens and the young silver salmon were found to be infested with monogenetic trematodes. About 25 specimens in all were collected from the cutthroats, the number of flukes per fish ranging from 1 to 10; only a single specimen each was found in the Dolly Varden trout and in the silver salmon. Examination of these flukes revealed that they belonged to the genus *Tetraonchus* Diesing and constituted a new species for which the name *Tetraonchus alaskensis* is hereby proposed.

Tetraonchus alaskensis, n. sp.

Description.—Body somewhat fusiform in outline (fig. 11, A), 2 mm long by 670 to 715μ wide, flattened dorsoventrally; cuticula with fine transverse striations but without spines or other cuticular ornamentations. Cephalic glands present on each side of pharynx, opening through several pairs of head organs located on each side of median line at anterior end of body. Haptor somewhat rectangular, 225 to 280μ wide, pedunculated, and armed with 2 pairs of hooks separated by a single cuticular bar, and with 16 hooklets. Hooks similar in shape; those of ventral pair (fig. 11, C) about 107μ long by 75μ wide, those of dorsal pair (fig. 11, D) about 110μ long by 75μ wide; bar lobed (fig. 11, E), about 30 to 35μ long by 20 to 25μ wide; hooklets about 12μ long. Oral aperture ventral, 190 to 240μ from anterior end of body; pharynx more or less globular, 225 to 235μ in diameter; intestine simple, sac-like, extending posteriorly in median line as far as distal limits of vitellaria. Eyes present, 2 pairs, sometimes poorly pigmented, located antero-dorsal to pharynx. Genital aperture median, 560 to 570μ

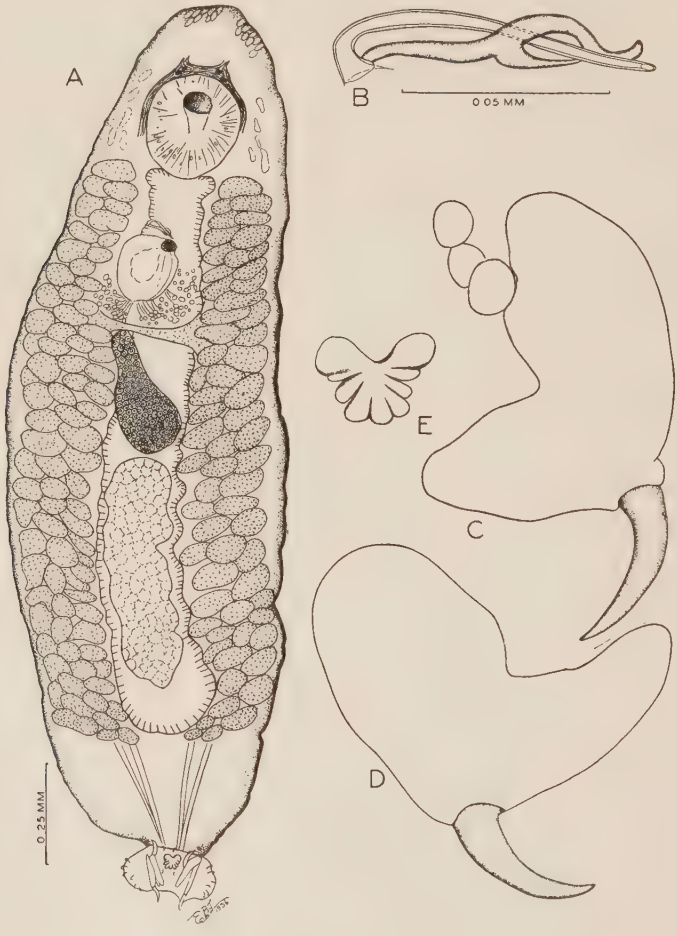

Fig. 11

Tetraonchus alaskensis
A—Entire worm, ventral view. B—Cirrus and supporting piece. C—Ventral hook of haptor. D—Dorsal hook of haptor. E—Supporting bar of haptor.

from anterior end of body. Cirrus (fig. 11, A) tubular, strongly curved proximally, 80μ long (disregarding curve), with bifid supporting piece about 60 to 65μ long. Testis median, postovarial, thin, elongate and irregular in outline, usually not observable in toto mounts. Ovary piriform, 260 to 295μ long by 150 to 165μ wide, in equatorial zone. Vitellaria lateral, extending from level of base of pharynx to posterior limit of intestine, follicles sometimes uniting posteriorly forming band across body. Vagina absent. Eggs not observed.

Hosts.—*Salmo mykiss* Walbaum, *Salvelinus malma spectabilis* (Giard) and *Oncorhynchus kisutch* (Walbaum).

Location.—Gills.

Distribution.—Alaska (Sitkoh Bay).

Specimens.—U. S. N. M. Helm. Coll. No. 41140 (type), No. 41141 (paratypes), No. 41142, and No. 41143.

The genus *Tetraonchus* Diesing belongs to the family Dactylogyridae Bychowsky and to the subfamily Dactylogyrinae Bychowsky. At present the genus contains only two species, *Tetraonchus monenteron* (Wagener) and *T. alaskensis*, described in this paper. These two species may easily be distinguished by the size of the body, width of haptor in comparison with body width, size and shape of haptoral bar, and shape of the supporting piece of the cirrus. *T. alaskensis* is about twice as long and more robust than *T. monenteron*, and the haptor of the former is only about one-half as wide as the body, whereas in the latter the haptor is as wide as, or wider than, the body. The haptoral bar of *T. alaskensis* is small and lobate while that of *T. monenteron* is relatively large and somewhat butterfly-shaped. The supporting piece of the cirrus of *T. alaskensis* is bifid distally, forming a guide through which the cirrus passes; in *T. monenteron* this piece is not bifid but forms a spiral around the distal end of the cirrus.

The infections produced in rats by a single larva of *Strongyloides ratti*.

George L. Graham, Rockefeller Institute for Medical Research, Princeton, N. J.

In a recent paper (Graham, 1936, Amer. J. Hyg., 24:71-87), the details of technique and the results obtained from the passage of *Strongyloides ratti* through 14 serial generations by means of single larva infections were presented. The larvae thus used were of the direct mode of development in each instance: 181 rats were exposed to a single larva each and of these 58, or 32 per cent, became positive subsequently as judged by the appearance of larvae in fecal cultures. In a footnote added in proof, the successful passage through the 18th generation was noted.

The serial passages have been continued, incidental to other investigations, and at the present time the pure-line strain has been passed through 26 generations.* On several occasions new strains were isolated from culture rat infections for test and once, one of these newly isolated strains was passed through the second single larva generation. The data concerning these additional strains are pooled with those of the initial strain, since, for this presentation, it seems desirable to give the complete experience with infections of this type.

From the 15th to the 25th generation inclusive, 195 rats were exposed to a single larva each and 34 positive infections obtained from them, about 17 per cent. In all, 376 rats have been exposed and 92, or 24 per cent, positive infections demonstrated. Thus, after the passage of these single larva infections through 12 additional generations, the statement made after 14 successful passages (Graham, 1936, p. 83) to the effect that "no evidence has accrued which would lead to the conclusion that indefinite maintenance by means of single homogonic larva transfers is impossible" is still acceptable.

With respect to the persistence of these single larva infections, a brief note has already been given (Graham, 1935, Anat. Rec., 64 (Sup. 1):109). The oldest infection then reported (200 days after exposure) has been surpassed in 5 additional cases. One infection is still yielding offspring 311 days after exposure of

*At the time proof of this note was read, the initial strain had been passed through 32 serial generations.

the host to a single larva of *S. ratti.* Is it possible that very light but persistent infections such as these may be a clue to the postulated phenomenon of "hyper-infection" which has been ascribed to this genus of nematodes?

A new species of cestode, *Dendrouterina nycticoracis* (Dilepidiidae), from the black-crowned night heron *(Nycticorax nycticorax hoactli* (Gmelin)). O. Wilford Olsen, (Paper No. 1464 of the Scientific Journal Series of the Minnesota Agricultural Experiment Station).

Of 6 specimens of the black-crowned night heron obtained from a rookery near St. Paul, Minnesota, and submitted to this laboratory for examination for parasite infection, 4 individuals, 2 adults and 2 juveniles, were found to harbor large numbers of a new species of cestode of the genus *Dendrouterina* Fuhrmann, 1912. The young birds had left the nests at this time (August 7, 1936) and were in the tree tops but had not as yet gone to the feeding grounds.

Fuhrmann (1912, Sitzungsb. K. Akad. Wiss., Wien Math.-Naturw. Kl. 121, Abt. 1 (4-5):181-191, figs. 1-7) proposed the generic name *Dendrouterina* for a new species, *D. herodiae,* of Dilepidiidae which he found in the little egret, *Herodias garzetta,* from Africa. Meggitt (1933, Rec. Indian Mus. 35 (2):145-165, figs. 1-21) described a second species, *D. fovea,* from the Indian tree-pie, *Dendrocitta rufa,* a passeriform bird, dying in the Zoological Gardens at Calcutta, India. The present paper constitutes a description of the third species of this genus and the first record of its occurrence in the western hemisphere.

Dendrouterina nycticoracis, sp. nov.

Description.—Length 10 to 17 mm, strobila consists of 45 to 100 proglottides which are broader than long, maximum width 0.740 mm. Rostellar sac 0.038 to 0.042 mm in diameter, extends to or caudad of anterior margin of suckers; rostellum protrusible, diameter 0.034 mm. Hooks of 2 sizes arranged in 2 rows of 9 each; large hooks 0.0282 to 0.0315 mm long, blade about one-half length of shaft; small hooks 0.0099 mm long. Scolex angular, width 0.140 to 0.180 mm, length 0.123 to 0.247 mm; suckers about 0.090 mm in diameter. Neck absent.

Musculature consisting of 3 distinct layers of longitudinal fibers, a single cuticular layer of about 150 small fibers and 2 layers of larger parenchymal fibers, the outer layer consisting of about 65 and the inner about 30 bundles. Neither dorso-ventral nor transverse fibers were seen.

Excretory system consisting of 2 pairs of longitudinal ducts without transverse connections; the ventral duct on the poral side is large, the dorsal very small, the opposite condition obtains on the aporal side.

Atrial pores unilateral, dextral, located near middle of proglottid or slightly anterior. Walls of genital atrium very thick. Male genital pore dorsal to female; cirrus unarmed, with 1 or 2 loops; cirrus pouch extending directly to near median line of proglottid tapering gradually to diameter of vas deferens which forms several loops, and then passing caudad dorsal to ovary where it receives the 3 principal ducts of the vasa efferentia. Testes usually 9 occasionally 10, arranged posterior to ovary and lateral on aporal side, size about 0.050 mm. Seminal vesicle not observed. Vagina thick walled in poral region; it extends meso-caudad on dorsal side of ovary, forming seminal receptacle just posterior to ovary, then bending dextrad to receive short oviduct which extends caudad from ovary; a short fertilization chamber lies between oviduct and vitelline duct. Mehlis' gland small; uterus extending cephalad as a slender duct between dorsal surface of ovary and vagina forming a T-shaped structure lying between the excretory vessels at the anterior margin of ovary. Gravid uterus large, sac-shaped, with few evaginations, filling space between excretory canals frequently extending beyond on aporal side. Oncospheres with thin embryophore, diameter 0.0083 to 0.01328 mm. Ovary elongated transversely, occupying about middle third of proglottid, with 4 to 6 lobes at each end. Vitelline gland triangular, immediately caudad of oviduct, somewhat smaller than testes.

Host.—*Nycticorax nycticorax hoactli* (Gmelin).

Habitat.—Duodenum.

Distribution.—St. Paul, Minnesota, U. S. A.

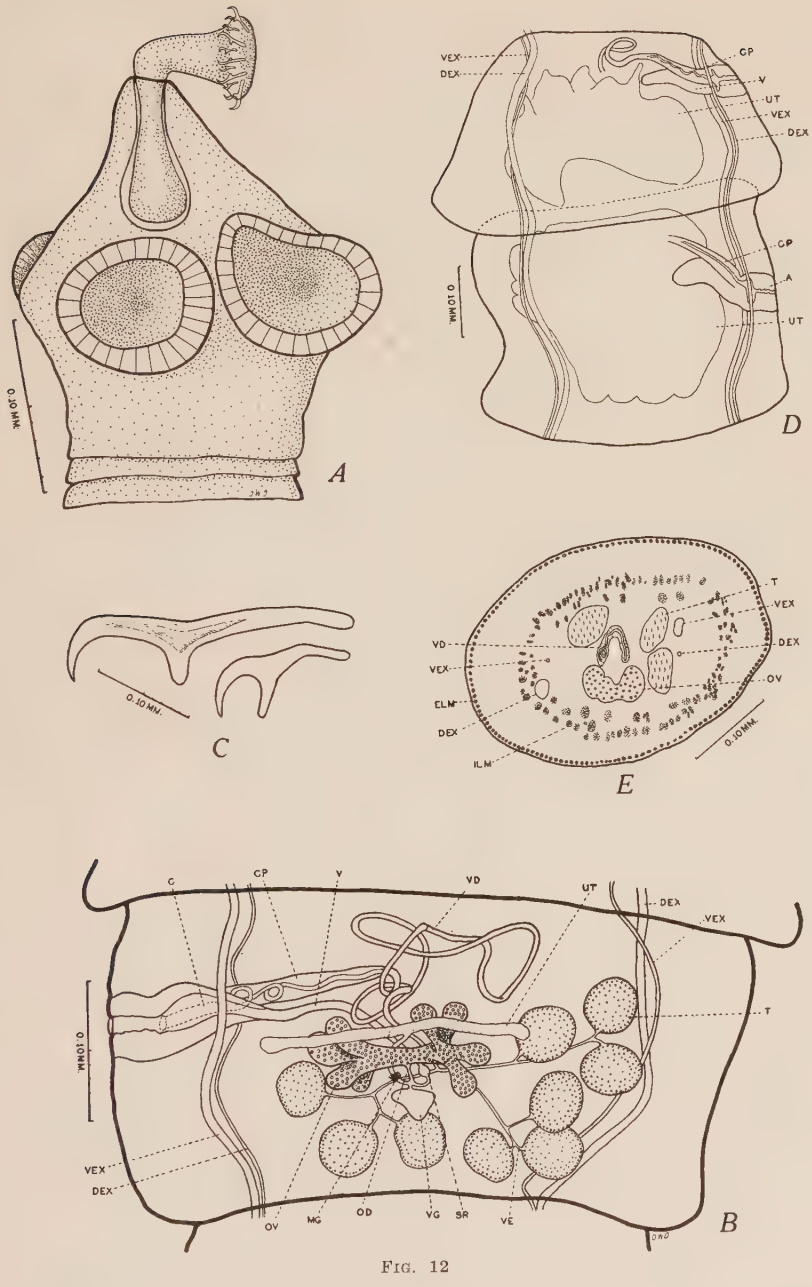

FIG. 12

Dendrouterina nycticoracis, sp. nov.

A—Scolex. B—Mature proglottid. C—Hooks. D—Ripe proglottides. E—Cross section of mature proglottid. A, atrium; C, cirrus; CP, cirrus pouch; DEX, dorsal excretory vessel; ELM, cuticular longitudinal muscles; MG, Mehlis' gland; OD, oviduct; OV, ovary; SR, seminal receptacle; T, testis; UT, uterus; VD, vas deferens; VE, vas efferens; VG, vitelline gland; VEX, ventral excretory vessel. (C—Scale of magnification should read 0.01 mm).

Cotypes.—U. S. N. M. Helm. Coll. No. 9024. Paratypes in the collection of the Division of Entomology and Economic Zoology, University of Minnesota, and of the author.

Dendrouterina nycticoracis, sp. nov. may be distinguished from *D. herodiae* and *D. fovea* by the following characters: (1) A maximum length of 17 mm as compared to 50 to 60 mm for *D. herodiae* and 35 to 40 mm for *D. fovea;* (2) *D. nycticoracis* has 18 hooks of two sizes, nine 0.028-0.031 mm long and nine 0.0099 mm long, *D. fovea* 70 hooks of one size, 0.018-0.021 mm, *D. herodiae* unknown since it possessed no scolex; (3) *D. nycticoracis* 9 to 10 testes, *D. herodiae* 44, and *D. fovea* 11 to 15; (4) *D. nycticoracis* and *D. fovea* have a sac-shaped uterus when gravid, *D. herodiae* horse-shoe shaped with numerous side branches particularly on outer margin; (5) cirrus pouch of *D. nycticoracis* long and slender and extends to near median line of body, *D. herodiae* and *D. fovea* not more than half the distance to the median line of body.

Tapeworm studies, IV. *Moniezia expansa* of sheep strain contracted by calf. Norman R. Stoll, Department of Animal and Plant Pathology, The Rockefeller Institute for Medical Research, Princeton, New Jersey.

A herd of cattle has been kept for 5 years in field VII at this laboratory with no cestodes ever demonstrated in them, although certain species of nematodes are present (Stoll, 1936, J. Parasitol. 22: 386-407). For slightly over 2 years sheep were pastured with the cattle. These sheep likewise remained free of *Moniezia expansa* in field VII, and contracted the tapeworm readily when transferred to a field infested with the parasite. This raised the natural question as to whether the bovine host would likewise readily contract *M. expansa* on appropriate sheep pasture exposure. A positive result was secured.

A Jersey-Guernsey heifer calf, born January 12, 1936, was removed from field VII on June 2, weighing 355 pounds at 5 months of age. After 2 weeks indoors, fecal examinations having shown as usual some nematode but no cestode infection, the calf was transferred to the infested field I-II for one day, June 17. The animal was again held indoors for 19 days and slaughtered July 7. Besides nematodes, there was recovered from the small gut one tapeworm 10 cm long, a young *Moniezia expansa* with discrete interproglottidal glands. The size is in the range of this species as recovered from sheep after a similar period since pasture exposure.

All pertinent facts are harmonious in the demonstration that the calf contracted *M. expansa* under normal grazing conditions of one day only in a sheep pasture. This evidences ability of the sheep strain of this *Moniezia* to infect the bovine host, while the susceptibility of a bovine host from field VII supplements earlier information as to the continuing absence of the cestode in the field VII herd of cattle.

A case of broad tapeworm in Syracuse, N. Y. Justus F. Mueller, College of Medicine, Syracuse University, Syracuse, N. Y.

During the last week of April, 1936, a small section of tapeworm passed by a female patient, 35 years of age, was sent to the Syracuse City Laboratory for diagnosis, and recognized as *Diphyllobothrium latum*. Upon treatment, 16 feet of worm with scolex were recovered. Since the patient gave a history of having passed similar proglottids four years earlier, but had not taken treatment, the worm must have persisted for at least that length of time.

The patient was of Jewish race, and from what could be learned, probably acquired the infection from the well known habit of tasting raw fish in the preparation of "gefüllte fish." She had come to this country from Poland 16 years ago, but it is improbable that she could have harbored the worm for this length of time. Since New York State fish are not known to carry the plerocercoids of this worm, it seems probable that the infected fish was shipped in from some region where the broad tapeworm is known to be endemic. This is the first record of this parasite for the city of Syracuse, and one of the few recorded cases for New York State.

Opuscula miscellanea nematologica, V. G. Steiner, U. S. Bureau of Plant Industry.

(1) TYLENCHORHYNCHUS CLAYTONI, N. SP., AN APPARENTLY RARE NEMIC PARASITE OF THE TOBACCO PLANT

Roots of tobacco plants (*Nicotiana tabacum* L. hybrid) collected in Florence, S. C., by E. E. Clayton of the U. S. Bureau of Plant Industry, harbored a new and apparently rare parasitic nematode of the genus *Tylenchorhynchus*, herein named *T. claytoni*, n. sp. It was found associated with *Heterodera marioni* (Cornu, 1879), Goodey, 1932, the root-knot nematode and *Pratylenchus pratensis* (de-Man, 1880) Filipjev, 1936. A total of 23 specimens of the new species was picked from an infested root, 9 females, 6 males and 8 larvae. All were distributed through the root parenchyma, indicating a vagrant mode of life.

Tylenchorhynchus claytoni, n. sp.
(fig. 13, A-E)

Description.—Body cylindrical, tapering anteriad from beginning of intestine, posteriad from in front of anus. Tail of female conoid-obtuse. Head set off button-like, with 3 annules, anteriorly broad-obtuse. Cuticle coarsely annulated except very end of female tail; annules longitudinally subdivided as shown in figure 13, E, with lateral, dorsal and ventral subdivisions somewhat larger. In side view, lateral fields appearing as 3 longitudinal ribbons, anteriorly beginning in region of proximal portion of buccal stylet; in female, ending near caudal terminus (fig. 13, C), in male in anal region (fig. 13, D). In esophageal region these ribbons subdivided transversely (areolated) through transgression of annulation marks (fig. 13, A). Phasmids present in female (fig. 13, C) and male (fig. 13, D); in the latter forming a false bursal rib. Buccal stylet about 20μ long, of medium strength, with basal knobs slightly oblong and not very strong. Esophagus typically tylenchoid. Female sexual apparatus amphidelphic, branches not reflexed. Male with large annulated bursa, beginning about twice spicula length in front of anus, posteriorly surrounding tail end.

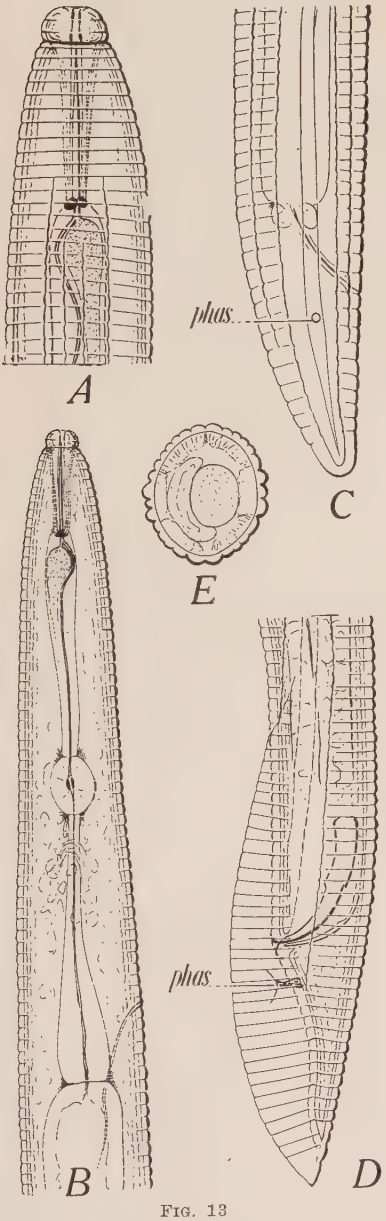

FIG. 13

Tylenchorhynchus claytoni, n. sp.

A—Head end; X 1,200. B—Anterior end; X 640. C—Tail end of female; *phas*, phasmid; X 824. D—Tail end of male; *phas*, phasmid; X 824. E—Cross section through middle region of body; X 824.

Measurements.—♀: total length = 0.64 to 0.73 mm; a = 24 to 25, β = 5 to 6.2, γ = 17.9 to 19.4, v = 55 to 57%. ♂: total length = 0.57 mm; a = 26, β = 5.8, γ = 14.6.

Diagnosis. — *Tylenchorhynchus* with structurally highly differentiated cuticle, which is coarsely annulated and longitudinally subdivided, forming thereby in middle region of body about 29 ridges. Head with only 3 annules. Lateral

fields in side view forming 3 ribbons, areolated in pre-intestinal region. Phasmids close behind anus. Buccal stylet not very strong, about 2½ times as long as width of head.

Type locality.—South Carolina, U. S. A.

Type host.—Hybrid of *Nicotiana tabacum* L.

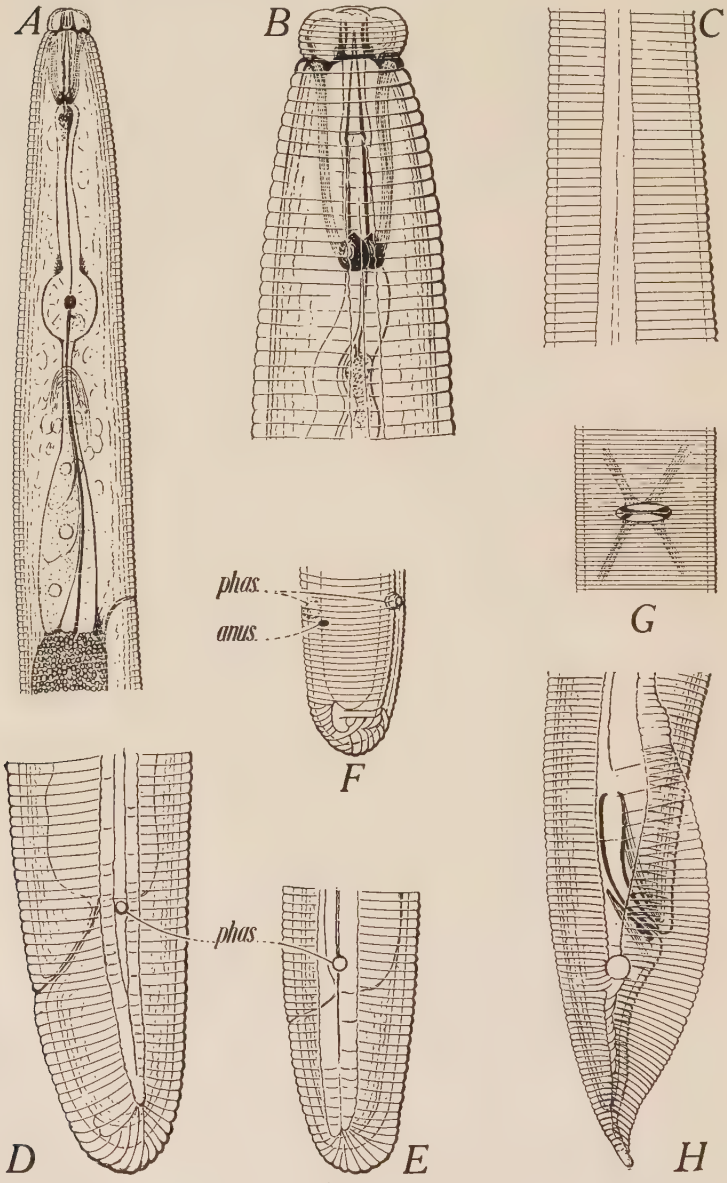

Fig. 14

Rotylenchus blaberus, n. sp.

A—Anterior end; X 540. B—Head end; X 1,200. C—Detail of annulation and lateral field where the latter separates into three longitudinal ribbons; X 810. D—Tail end of female; *phas*, phasmid; X 810. E—Tail end of female with some variation in position of phasmid, in structure of lateral field and in annulation; *phas*, phasmid; X 810. F—Tail end of female in sinistro-ventro-submedial view; *phas*, phasmid; X 540. G—En face view of vulva with the four dilatator muscles; X 540. H—Tail end of male; X 810.

(2) ROTYLENCHUS BLABERUS, N. SP., A NEMATODE PARASITE OF YAMS (DIOSCOREA SP.)

Steiner and LeHew in 1933, West in 1934 and Goodey in 1935 described a disease of yams caused by the tylenchid nematode *Rotylenchus bradys* (Steiner and LeHew, 1933) Filipjev, 1936. This disease is at present known to occur in Jamaica, in Puerto Rico and in Ibadian, Nigeria (Africa). Yams intercepted in Boston in April, 1935, by quarantine inspector C. A. Davis and said to have originated from Port Harcourt, West Coast of Africa, were found to be infested to about 50 per cent by still another *Rotylenchus* species, differing in some characters from *R. bradys*. The name *Rotylenchus blaberus*, n. sp. (βλαβερος = noxious) is here proposed for this new species. *Rotylenchus* is a generic name only recently proposed by Filipjev for forms formerly placed with *Anguillulina* or with *Hoplolaimus*. A full discussion of the relationship of the new genus to *Hoplolaimus* and related forms will be given in another paper and it will be shown that *Rotylenchus*, as well as *Hoplolaimus*, are genera with numerous species.

In the present case, the nematodes were found in spots under the surface of the yam to a depth of about one-fourth inch, with the infested areas discolored a bright yellow. Of 116 specimens counted, there were 63 females, 18 males and 35 larvae, thus giving a sex number of between 28 and 29.

Rotylenchus blaberus, n. sp.

Description.—Body cylindrical, tapering anteriorly from region of nerve ring, posteriorly from slightly in front of anus. Tail conically obtuse, about 1⅓ as long as anal body width. Cuticular annulation following contour of tail. Annulation laterally interrupted by 3 longitudinal ribbons, 2 of which begin in middle region of unprotruded buccal stylet (fig. 14, B) then separate into 3 in front of intestine (fig. 14, C) and in the female reduce to 2 in front, or a short distance behind, the scutellum (phasmid) and terminate in front of tail end (fig. 14, D & E). At anterior and also posterior end these longitudinal ribbons transversely irregularly subdivided into areolae (fig. 14, B, D, E). Scutellum (phasmid) small, in female always located in front of anal opening. In male, middle and ventral lateral ribbons ending at beginning of bursa, dorsal one near tail end, with scutellum (phasmid) behind anus (fig. 14, H). Head set off button-like, with 7 to 8 annules; cuticular framework well developed, particularly also the attachment frame of the protrudor muscles of the stylet. Stylet strong, about 28μ long, with basal knobs slightly egg-shape. Esophagus typical (fig. 14, A); esophageal glands posteriorly not overlapping end of esophagus. Intestinal cells indistinct, densely filled with globular reserve material which, after death, often coagulate to irregular masses; rectum fine, even obscure. Anal opening very small of transverse oval shape (fig. 14, F). Excretory pore slightly in front of anterior end of intestine (fig. 14, A).

Vulva as in figure 14, G, with small cuticular reinforcements near end of each lip. Dilatatores vulvae as shown in same figure. Vagina directed straight inward, short, with thickened walls, leading into ovejector, which connects with anterior and posterior uterus.

Male tail as shown in figure 14, H. Gubernaculum lineate but distal end folded back; muscles as shown in figure. Bursa not simply a membrane but in cross section of somewhat triangular shape.

Measurements.—♀: total length = 0.85 to 1.00 mm; a = 26 to 29, β = 7.1 to 7.7, γ = 26 to 33.1, v = 56 to 58 %. ♂: total length = 0.85 mm; a = 28 to 29.8, β = 4.4 to 5.2, γ = 26.8 to 29.8.

Diagnosis.—*Rotylenchus* resembling *R. bradys* but with the following differences: Head with only 7 to 8 annules instead of about 11, as in *R. bradys;* lateral fields separating into 3 ribbons posterior to nerve ring, not in latitude of buccal stylet as in *R. bradys*, and again reduced to 2 anterior to scutellum, rarely behind; scutellum in females almost always anterior to anus; basal knobs of stylet not cut out anteriorly; lineate gubernaculum distally folded, not with short backward directed processus as in *R. bradys*.

Type locality.—Port Harcourt, Nigeria, Africa.

Type host.—*Dioscorea* sp.

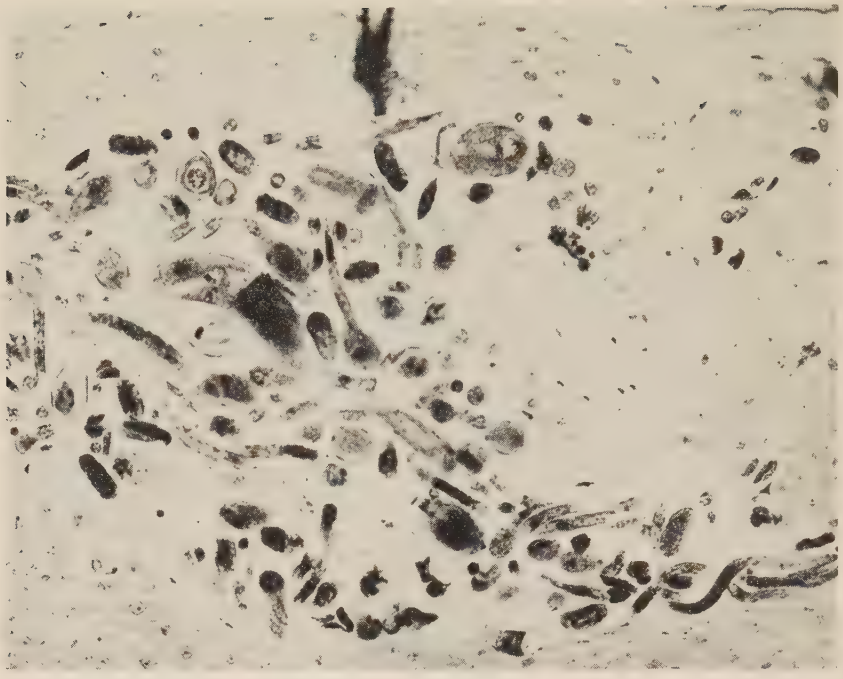

Fig. 15

Cross section through flower of *Saccharum spontaneum* (L.) with nematode *Anguina spermophaga* through the tissue; X 157. Photomicrograph prepared by E. Artschwager, Division of Sugar Plant Investigations, U. S. Bureau of Plant Industry.

(3) ANGUINA SPERMOPHAGA, N. SP., A SEED PARASITE OF SACCHARUM SPONTANEUM (L.)

E. Artschwager and Mrs. R. Starrett of the Division of Sugar Plant Investigations, U. S. Bureau of Plant Industry, submitted to the writer cross sections (fig. 15) through the young flower of *Saccharum spontaneum* exhibiting numerous nematodes of the seed infesting type. Fortunately not all infested inflorescences had been sectioned and therefore entire specimens of the nematode could be studied. The infested plants were grown at Arlington Farm, Va., but originated from seeds collected in Turkestan (U. S. S. R.). It was therefore not possible to determine exactly the origin of the infestation. All material had been fixed; living specimens for experimental work were therefore not available.

The number of species of the genus *Anguina* Scopoli, 1777, em. Filipjev, 1936 is not large; they closely resemble each other morphologically. But the present new species is quite easily distinguished because of the posteriorly lobate bursa of the male.

Anguina spermophaga, n. sp. (fig. 16, A-G) (σπερμοφαγος = eating seeds).

Description.—Body of male quite cylindrical, that of female slightly spindle-shaped, usually larger than that of male. In both sexes body tapering rapidly anterior to intestine, posterior to vulva in female and to anus in male. Tail short-conical, most often with mucronate terminus. Cuticle finely annulated. Head slightly set off; its base with a framework of 6 cuticularized, anteriorly convex arcs (fig. 16, C). Buccal stylet rather weak, with small basal knobs. Esophagus tylenchoid, middle bulb with small valves, terminal bulb quite large, with esophageal glands inside bulb. Rectum very fine, almost obscure. Excretory pore ventrad of terminal esophageal bulb, behind nerve ring.

Female sexual apparatus with short postvulvar uterine branch, extending about half the distance from vulva to anus (fig. 16, E). End of ovary in fully grown specimens reflexed backward and then again forward. Eggs 30 to 32.3μ by 64.5 to 68.8μ.

Male with bursa beginning in front of spicula, ending near tail end, each wing forming there a rounded lobe, but these 2 lobes surpassed by mucronate caudal terminus (fig. 16, F & G). Spicula about two-thirds as long as tail, rather strong, proximally faintly capitate, distally knife-shaped. Gubernaculum near-lineate, almost one-half spicula length.

Smallest larva (? 2d stage) 0.331 mm long, with esophagus of 0.09 mm.

Measurements.—♀ : total length = 1.7 to 1.8 mm; a = 35.8 to 37.6, β = 8.9 to 10, γ = 33 to 35, v = 87 to 91%. ♂ : total length = 1.3 to 1.4 mm; a = 31 to 35, β= 8.9, γ = 21.6 to 24.

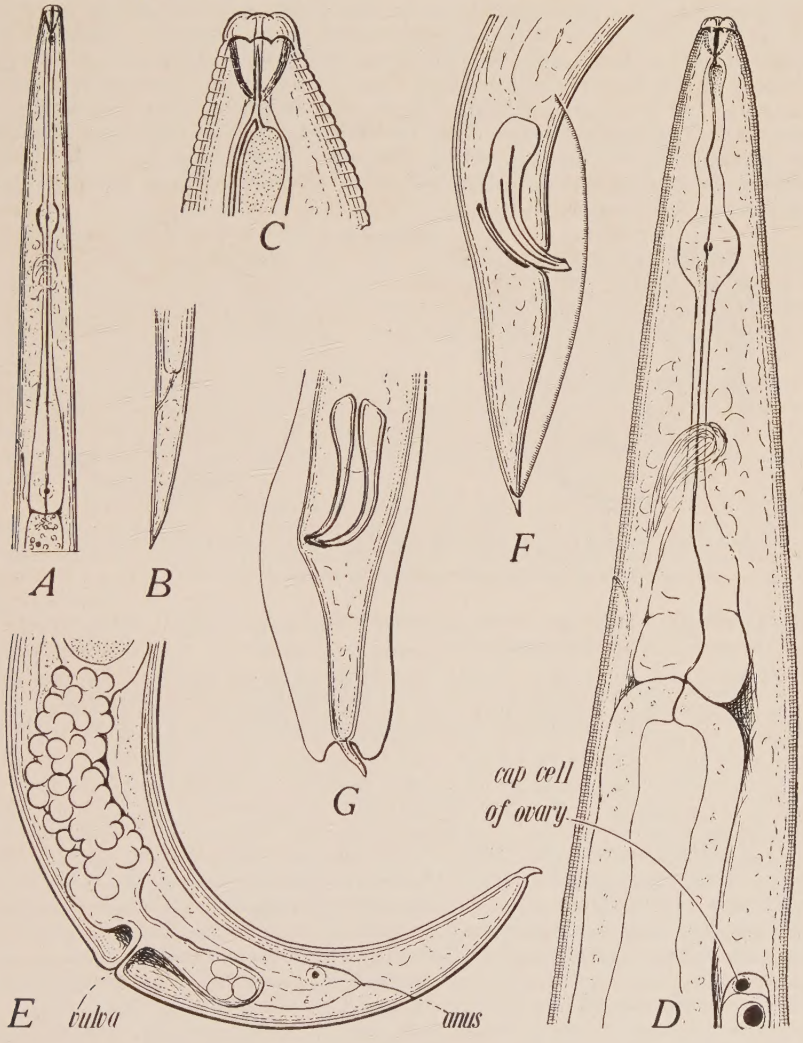

FIG. 16

Anguina spermophaga, n. sp. ex *Saccharum spontaneum* (L.)
A—Anterior end of young (? 2d stage) larva; X 640. B—Same, tail end; X 640. C—Head end of adult female; X 1,600. D—Anterior end; X 640. E—Tail end of female; X 640. F—Tail end of male in side view; X 640. G—Tail end of male, sinistro-ventro-submedial view; X 640.

Diagnosis.—*Anguina* with slightly mucronate tail end in female and male; with large bursa, each wing ending posteriorly in rounded lobe; these lobes surpassed by mucro of tail end. Spicula without a middle swelling.

Type locality.—Either Turkestan (U. S. S. R.) or Virginia, U. S. A.

Type host.—*Saccharum spontaneum* (L.), inflorescence.

(4) REMARKS CONCERNING HETERODERA MARIONI (CORNU) GOODEY, THE ROOT-KNOT NEMATODE IN BULBS OF ORNITHOGALUM SAUNDERSIAE (MARLOTH)

Attention is called to another case in which the root-knot nematode attacks a subterranean non-root structure of a plant. This case involves bulbs of *Ornithogalum saundersiae* var. "Mrs. Saunders's" (according to Johnson's Dictionary, introduced into Great Britain from South Africa in 1795), where the aforementioned nemic parasite locates and attacks the scales (leaves!) of the bulb of the plant (fig. 17). Unfortunately only a single bulb was available, so preserved that a histological study of the diseased tissues was not possible. Although the present bulb was devoid of roots, it is assumed that these too are attacked. The presence of the disease in such bulbs is of particular interest from the quarantine point of view, since bulbs devoid of roots may be carriers and distributors of this pest. The bulb originated from Stellenbosch, South Africa, was classified taxonomically by D. Lumsden, and was submitted to the author by D. P. Limber, both of the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, Washington, D. C.

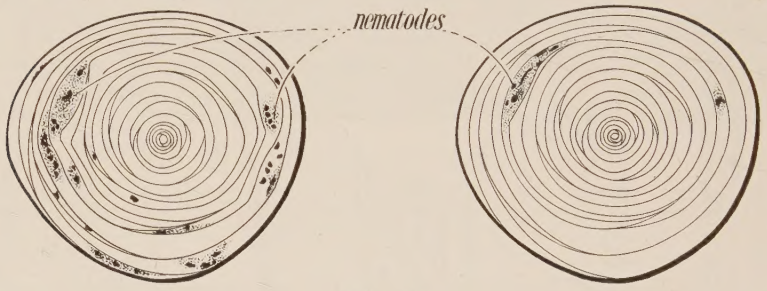

FIG. 17

Cross sections through bulb of *Ornithogalum saundersiae* showing root knot nematodes, *Heterodera marioni* (Cornu) Goodey, in situ in the bulb scales; at left section through center of bulb, at right section near top of bulb; X 1.2.

The frequency of change of cecal contents in fowls. PAUL D. HARWOOD, U. S. Bureau of Animal Industry.

Olson and Mann (1935, J. Amer. Vet. Med. Assoc. 87 (n. s. 40) (2):151-160) have reported that certain dyes, when introduced into the ceca of chickens by feeding dye-marked foods, show no noticeable diminution of concentration after 48 hours, are frequently present after 96 hours, and are not completely evacuated until 120 hours after cessation of the dye feeding. A knowledge of the time required for expulsion of the cecal contents is of importance in the critical testing of anthelmintics, especially in treatments for the removal of heterakids, since treated birds should be held until all dead worms have been passed. Furthermore, digestion of a helminth, and even of its resistant cuticle, might take place if retained for 5 days. Since dyes are such extremely diffusible substances, and since differences in their concentrations are difficult to determine, it appeared that a test of a more precise quantitative sort might prove to be reliable. Consequently, an experiment was carried out using *Lycopodium* spores, which are easily detected on microscopic examination.

Ten chickens of mixed breed were used in the experiment, 2 birds being placed in the same cage, and given as food a dry mash containing a known quantity of *Lycopodium* spores. The chickens used were pullets from 5 to 7 months old when subjected to the feeding test. After 2 to 4 days on this diet one bird was killed; the other was killed 48 hours later, meanwhile being fed on a dry mash which contained no spores. The dry mash fed to the chickens consisted of

yellow corn meal, 40 pounds; wheat bran, 20 pounds; wheat middlings, 20 pounds; alfalfa leaf meal, 5 pounds; dried buttermilk, 4 pounds; fish meal (60 to 70 per cent), 4 pounds; meat scrap (50 to 65 per cent), 4 pounds; oyster shell pulverized, 2 pounds; salt, 1 pound; and cod liver oil, 1 pound. The ceca were removed and the contents of each scraped into separate dishes where they were thoroughly mixed by stirring for several minutes. A few milligrams of the cecal contents were then weighed to the nearest 1/10 milligram and the spore content counted directly with the aid of a microscope. The counts were made from the contents of each cecum, the counts were reduced to the basis of a 10-milligram sample, and the average counts are reported in the following protocols. To reduce the error caused by evaporation, the cecal contents were kept in covered dishes, as much as possible. No attempt was made to distinguish between the right and left cecum.

The first pair of chickens was fed on a mash containing 3 per cent by weight of *Lycopodium* spores. After 4 days on this mash the first bird was killed and its ceca were found to contain 62 and 52 spores, respectively, per 10-milligram sample. The second bird was killed 48 hours later and its ceca were found to contain 2 and 1 spores, respectively, per 10-milligram sample.

The second pair of chickens was fed on a mash containing 1 per cent by weight of *Lycopodium* spores. After 4 days on this mash the first bird was killed and its ceca contained 122 and 293 spores, respectively, per 10-milligram sample. The second bird was killed 48 hours later; its ceca contained 11 and 3 spores, respectively, per 10-milligram sample.

The chickens of the third pair were on the same mash as those of the second pair. After 4 days on this mash the first bird was killed; its ceca contained 90 and 96 spores, respectively, per 10-milligram sample. The second bird was killed 48 hours later; its ceca contained 7 and 3 spores, respectively, per 10-milligram sample.

The fourth pair of chickens was fed on the same mash as those of the second and third pair. After 4 days on this mash the first bird was killed; its ceca contained 159 and 157 spores, respectively, per 10-milligram sample. The second bird was killed 48 hours later; its ceca contained 2 and 3 spores, respectively, per 10-milligram sample.

The fifth pair of chickens was fed on the same mash as those of the second, third and fourth pairs. After 2 days on this mash the first bird was killed; its ceca contained 59 and 56 spores, respectively, per 10-milligram sample. The second bird was killed 48 hours later; its ceca contained 4 and 11 spores, respectively, per 10-milligram sample.

The average spore count per 10-milligrams of cecal contents for the birds killed while feeding on a mixture of mash and *Lycopodium* spores is 100.6; that for their mates, killed 48 hours later, is 4.6 spores. Therefore, approximately 95 per cent of the spores were evacuated in the 2 days after cessation of spore feeding. These data were analyzed statistically and found significant.

MINUTES

One hundred eighty-first and one hundred eighty-second meetings

The 181st meeting was held October 17, 1936. Officers were elected: President, Dr. W. H. Wright; Vice President, Dr. B. G. Chitwood; Corresponding Secretary-Treasurer, Miss Edna M. Buhrer; Recording Secretary, Dr. W. H. Krull.

Dr. J. R. Christie was reelected editor of the PROCEEDINGS. Dr. H. E. Ewing was reelected to the editorial committee.

The meeting time of the Society was changed to the 3rd Tuesday of the month at 5 P. M.

Papers or notes were presented by Steiner, Scott, Hoffman, Brown, Graham and Stoll.

The 182nd meeting was held Nov. 17, 1936. Papers or notes were presented by Steiner, McIntosh, Hall, Cram and Chitwood.

WENDELL H. KRULL, Recording Secretary.

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